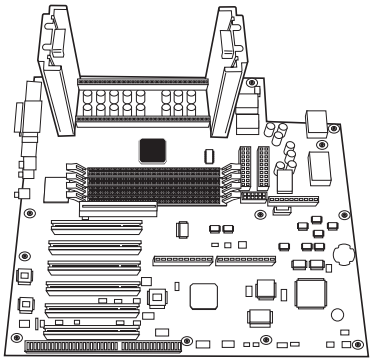
MS440GX Motherboard Product Guide



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Contents

Acronyms 9

1 Motherboard Features

Summary of Features 12
Board Layout 13
Motherboard Part-Function Table 14
Microprocessor 15
Processor Packaging 15
Second Level Cache 15
Processor Options 15
Form Factor 16
Chipset 16
82443GX PCI/A.G.P. Controller (PAC) (H) 17
Intel® 82371EB Xcelerator (PIIX4E) (Q) 18
Intel® 82093AA I/O Advanced Programmable Interrupt Controller (IOAPIC) 19
IDE Support 19
Real-Time Clock, CMOS RAM, and Battery 20
Diskette Drive Controller 20
Accelerated Graphics Port (A.G.P.) Support 21
Memory 21
Input/Output (I/O) Controller (O) 22
82558 PCI LAN Controller (D) 23
EtherExpress™ PRO/100 WfM PCI LAN Subsystem 23
Alert On LAN Component 24
Audio Subsystem 24
Audio Drivers and Utilities 25
Hardware Monitor Subsystem 25
Power Supply 26
Power Supply Considerations 26
Expansion 27
Basic Input/Output System (BIOS) 27
BIOS Upgrades 27
BIOS Flash Memory Organization 28
Piezoelectric Speaker (N) 28

2 Installation and Removal Procedures

Safety Considerations 30
How to Install the DRM Fans and Processor Retention Mechanism 30
Materials Required 31
How to Install a Single Processor 37
How to Install a Second Processor 38
How to Remove and Install the Motherboard 40
How to Set Processor Speed 41
Jumper Settings 42

How to Remove a Processor....43
How to Upgrade a Processor....44
How to Install the Termination Card....45
How to Remove the Termination Card....46
How to Install Memory....47
How to Remove Memory....48
How to Replace the CR2032 Lithium Battery (M)....49
How to Clear Passwords....51

3 Using the BIOS Setup Program

Setup Program Modes....54
Modes....54
Mode Control....54
Setup Program Menus....55
Menu Functionality....56
Menu Function Keys....56
Maintenance Menu....57
Main Menu....57
Advanced Menu....58
Peripheral Configuration Submenu....59
IDE Configuration Submenus....60
Floppy Options Submenu....61
DMI Event Logging Submenu....62
Video Configuration Submenu....62
Security Menu....63
Power Menu....63
Boot Menu....64
Boot Options....65
Hard Drive Submenu....65
Removable Devices Submenu....66
Exit Menu....66

4 Using the BIOS Features

How to Prepare for the Upgrade....68
Obtaining the BIOS Upgrade File....68
Recording the Current BIOS Settings....68
Creating a Bootable Floppy Disk....69
Creating the BIOS Upgrade Floppy Disk....69
Upgrading the BIOS....70
Recovering the BIOS....71
Changing the BIOS Language....72
Plug and Play: PCI Autoconfiguration....72
ISA Plug and Play....73
ISA Legacy Devices....73
PCI IDE Support....73
Desktop Management Interface (DMI)....74
Advanced Power Management (APM)....74

Advanced Configuration and Power Interface (ACPI) 75
System States and Power States 75
Wake Up Devices and Events 76
Plug and Play 76
BIOS Support 76
Language Support 76
OEM Logo or Scan Area 76
USB Legacy Support 77
BIOS Security Features 77
Recovering BIOS Data 78

5 Technical Reference

Front Panel Connectors (L) 80
Speaker 81
Reset Switch 81
Power/Sleep LED 82
Hard Drive Activity LED 82
Infrared Port 82
Power Switch 82
Front Panel Pin Connector Mapping 83
Back Panel Connectors (E) 84
Keyboard and Mouse Interface 85
Universal Serial Bus (USB) 85
Parallel Port 86
Serial Ports 86
I/O Shield 88
Midboard Connectors 89
Add-in Card Connectors 90
Audio Connectors 91
CD-ROM Audio 92
Telephony 92
Fan Connectors 93
Thermal Considerations 94
Power Connectors 96
Peripheral Interface Connectors 99
Security and Hardware Management Connectors 100
Chassis Intrusion Connectors 102
Wake on LAN Technology Connector 102
Wake on Modem 102
Memory Map 103
DMA Channels 103
I/O Map 104
PCI Configuration Space Map 106
LAN Subsystem Software 107
Interrupts 107
PCI Interrupt Routing Map 108
Interrupt Routing Example 109

A Error Messages

BIOS Beep Codes 112
BIOS Error Messages 113
Port 80h POST Codes 115

B Regulatory and Integration Information

Regulatory Compliance 122
Product Certification Markings 122
Installation Precautions 122
Installation Instructions 123

C Environmental Specifications and Reliability Information

Environmental Specifications 126
Reliability Information 126

D Specifications and Customer Support

Online Support 128
Specifications 128

Figures

1. MS440GX Main Board Components 13
2. MS440GX Custom ATX Form Factor 16
3. Procedure Step 2: DRM Stand 31
3a. Procedure Step 3: DRM Stand With Fans 31
3b. Procedure Step 5: Fan Positioning/Air Flow 32
3c. Procedure Step 6: DRM Base With Retention Clip 32
3d. Procedure Step 7: Fans and Fan Header in Chassis 33
3e. Procedure Step 11a: Installing the DRM 33
3f. Procedure Step 13: CPU/Heat Sinks-DRM Tops 34
3g. Procedure Step 14: DRM Tops, Clips, Holes 34
3h. Procedure Step 16: Processors Installed in the DRM 35
3i. Procedure Step 17: Final DRM-Fan Assembly 36
4. Installing a Single Processor 37
5. Installing a Second Processor 39
6. Motherboard Mounting Screw Holes 40
7. Configuration Jumper Block 42
8. Removing a Processor 43
9. Installing the Termination Card 45
10. Removing the Termination Card 46
11. Installing a DIMM 48
12. Replacing the Battery 50
13. Setup Program Menu Structure 55
14. Front Panel Connectors 80
15. Back Panel Connectors 84
16. Back Panel I/O Shield Dimensions (ATX Chassis-Independent) 88
17. Add-in Card Connectors 90
18. Audio Connectors 91
19. Fan Connectors 93

20. Thermally Sensitive Components 94
21. Power Connectors 96
22. Peripheral Interface Connectors 99
23. Security and Hardware Management Connectors 100

Tables

1. Motherboard Part-Function Table 14
2. PCI/A.G.P. Controller Features 17
3. 82371EB Xcelerator Features 18
4. DIMM Sizes Supported 21
5. I/O Controller Components 22
6. LAN Controller Functions 23
7. Audio Subsystem Resources 25
8. Power Usage 26
9. DC Voltage Tolerances and Estimated Current Requirements (no PCI or A.G.P. shown) 26
10. Flash Memory Organization 28
11. BIOS Setup Configuration Jumper Settings 43
12. Setup Program Modes 54
13. Jumper Settings 54
14. Setup Menu Bar 56
15. Setup Function Keys 56
16. Maintenance Menu 57
17. Main Menu 57
18. Advanced Menu 58
19. Peripheral Configuration Submenu 59
20. IDE Configuration Submenus 60
21. Floppy Options Submenu 61
22. DMI Event Logging Submenu 62
23. Video Configuration Submenu 62
24. Security Menu 63
25. Power Menu 63
26. Boot Menu 64
27. Hard Drive Submenu 65
28. Removable Devices Submenu 66
29. Exit Menu 66
30. Recommendations for Configuring an ATAPI Device 73
31. Effects of Pressing the Power Switch 75
32. Wake Up Devices and Events 76
33. Administrator and User Password Functions 78
34. Front Panel I/O Connectors 81
35. Pin Connector Functionality 83
36. PS/2 Keyboard/Mouse Connectors 85
37. LAN Connector 86
38. Audio Line In Connector 86
39. Audio Line Out Connector 87
40. Audio Mic In Connector 87

41. Connector Groups 89
42. ATAPI-Style Telephony Connector(J1E1) 92
43. ATAPI CD Audio Connector (J2E1) 92
44. External Speaker Connector (J12A1) 92
45. MIDI/Joystick Connector (J2E2) 92
46. Fan Connectors 94
47. Thermal Considerations for Components 95
48. 1x6 Power Connector 97
49. Primary and Secondary Power Supply Connectors (J10H1) 97
50. VRM Connector (J13J1) 98
51. SCSI LED Connector (J10A1) 99
52. Front and Rear Chassis Intrusion Connectors 101
53. Wake on LAN Technology Connector (J11A2) 101
54. Wake-on-Modem Connector (J9A1) 101
55. Memory Map 103
56. DMA Channels 103
57. I/O Map 104
58. PCI Configuration Space Map 106
59. Interrupts 107
60. PCI Device Classes 108
61. PCI Interrupt Routing Map 108
62. Beep Codes 112
63. BIOS Error Messages 113
64. Port 80h Codes 115
65. Safety Regulations 122
66. EMC Regulations 122
67. Environmental Specifications 126
68. Compliance with Specifications 128

Acronyms

Acro.	Meaning	Acro.	Meaning	Acro.	Meaning	Acro.	Meaning
ACPI	Advanced configuration and power interface	ECC	Error checking and correcting	IRQ	Interrupt request	POST	Power-on self test
ADPCM	Adaptive differential pulse code modulation	ECHS	Extended cylinder head sector	LAN	Local area network	SCI	Special circumstance instructions
A.G.P.	Accelerated graphics port	ECP	Extended capabilities port	LBA	Logical block addressing	S.E.C.C.	Single edge contact cartridge
APM	Advanced power management	EMC	Electromag-netic compatibility	LED	Light emitting diode	SIR	Surface insulation resistance
BIOS	Basic input / output system	EPP	Enhanced parallel port	MHz	Megahertz	SMI	System management interrupt
CMOS	Complemen-tary metal oxide semiconductor	ESCD	Extended system configuration data	MIF	Management information format	SMM	System management mode
CPU	Central processing unit	ESD	Electrostatic DISCHARGE	MIDI	Musical interface digital interface	SMP	Symmetric multi-processing
CSMA/CD	Carrier sense multiple access with collision detection	FIFO	First in, first out	MTBF	Mean time between failures	SRAM	Static random access memory
DIMM	Dual inline memory module	IDE	Integrated dual channel enhanced	NIC	Network interface card	UHCI	Universal host controller interface
DMA	Direct memory access	I/O	Input / output	OEM	Original equipment manufacturer	USB	Universal serial bus
DMI	Desktop Management Interface	IOAPIC	Input Output Advanced Programmable Input Controller	OS	Operating System	VID	Voltage ID
DRAM	Dynamic random access memory	IPL	Initial program load	PAC	PCI A.G.P. controller	VPD	Vital product data
DRM	Dual retention mechanism	ISA	Industry standard architecture	PCI	Peripheral component interconnect	WfM	Wired for management

1 Motherboard Features

The MS440GX is designed specifically for the DCC, MCAD, and EDA markets with a high performance workstation.

This chapter describes the features of the MS440GX motherboard. The chapter covers the following topics:

Topic	Page
Summary of Features	12
Board Layout	13
Motherboard Part-Function Table	14
Microprocessor	15
Processor Packaging	15
Second Level Cache	15
Processor Options	15
Form Factor	16
Chipset	16
PCI/A.G.P. Controller	17
82371EB Xcelerator	18
I/O Advanced Programmable Interrupt Controller	19
IDE Support	19
Real-Time Clock, CMOS SRAM, and Battery	20
Diskette Drive Controller	20
A.G.P. Support	21
Memory	21
I/O Controller	22
PCI LAN Controller	23
EtherExpress™ PRO/100 WfM PCI LAN Subsystem	23
Alert on LAN Component	24
Audio Subsystem	24
Audio Drivers and Utilities	25
Hardware Monitor Subsystem	25
Power Supply	26
Power Supply Considerations	26
Expansion	27
Basic Input/Output System (BIOS)	27
BIOS Upgrades	27
BIOS Flash Memory Organization	28
Piezoelectric Speaker	28

Summary of Features

The MS440GX motherboard features are summarized below.

Form factor	Custom ATX (12 inches by 13 inches)
Processor(s)	• Two Slot 2 connectors • Support for one or two Pentium® II Xeon™ processors • 100 MHz host bus speed • Up to 1 MB of L2 cache support on each processor
Chipset	Intel® 82440GX, consisting of: • 82443GX PCI/A.G.P. controller (PAC) • 82371EB PCI ISA IDE Xcelerator (PIIX4E)
Memory	• Four DIMM sockets • Support for up to 2 GB of 100 MHz SDRAM • Support for ECC DIMMs only (see Table 4 and associated text)
I/O Control	• National Semiconductor PC97307 I/O controller
Peripheral Interfaces	• Two serial ports • Two USB ports • One parallel port • Two IDE interfaces with Ultra DMA support • One diskette drive interface
Video	• One A.G.P. slot
Audio	• Crystal Semiconductor CS4235 audio codec • Crystal Semiconductor CS9236 wavetable synthesizer
LAN	• Intel® 82558 10/100 Mbps PCI LAN controller
Hardware Monitor	• Microprocessor system hardware monitor (Analog Devices ADM9240 or equivalent) • Wired for Management (WfM) compliant
Expansion Capabilities	• Five PCI slots • One shared slot for either a PCI or an ISA add-in card
BIOS	• Intel® E28F004BXT80 4 Mbit flash memory • Support for SMBIOS, ACPI, APM, and Plug and Play

Board Layout

The illustration below is a picture of the MS440GX integrated motherboard. The main board components are identified by alphabetical callouts.

This board supports the Slot 2 processor (DS2P) family. It is a custom ATX form factor (12”x13”) board with an ATX I/O panel.

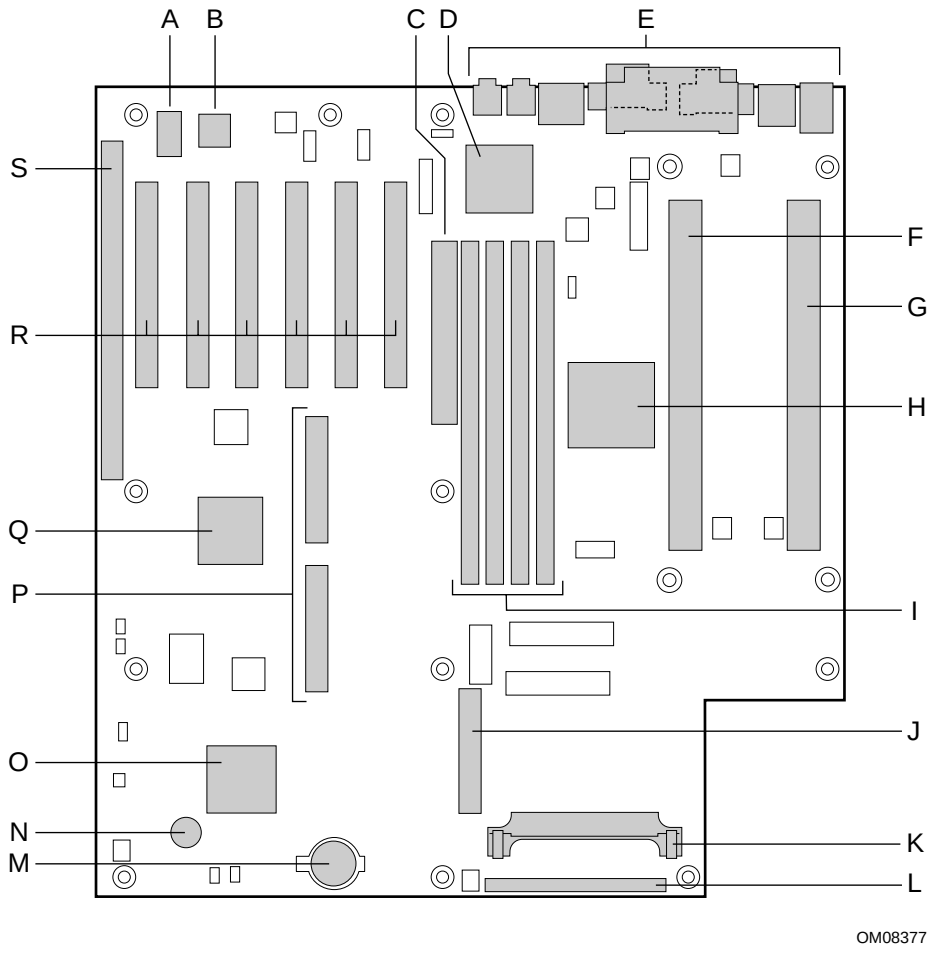


Figure 1. MS440GX Main Board Components

Motherboard Part-Function Table

This table identifies the motherboard components called out in Figure 1 and defines the functional purpose of each.

Table 1. Motherboard Part-Function Table

Callout ID	Part (Component)	Function
A	Intel E28F004BXT80 4 Mbit Flash Memory	Flash upgradable. Stores BIOS, Setup program, POST, APM, PCI auto configuration utility and Plug and Play code
B	Crystal Semiconductor CS4235 Audio Codec	On board audio subsystem with integrated FM synthesizer
C	A.G.P. Connector	High performance graphics connector with support for 133 MHz data transfer rates (AGP2x)
D	Intel 82558 PCI LAN Controller	On board LAN controller with support for 10Base-T and 100Base-TX interfaces
E	Back Panel Connectors	Keyboard, mouse, USB, parallel, serial, LAN and audio connectors
F	Slot 2 Connector for Boot Processor	Connector for Pentium II Xeon processor
G	Slot 2 Connector for Application Processor	Connector for Pentium II Xeon processor
H	Intel® 82443GX (PAC)	AGPset provides bus-control signals, address paths and data paths for transfers between the processor's host bus, PCI bus, the A.G.P. and main memory
I	DIMM Sockets	Support for up to 2GB PC100 compliant SDRAM DIMMS
J	Diskette Drive Connector	Supports one or two diskette drives
K	VRM Connector	Plug-in Voltage Regulator Module for application processor
L	Front Panel Connectors	Connectors for PC speaker, reset switch, power LED, HDD LED, infrared port and power switch
M	Battery	Provides power to real-time clock and CMOS memory
N	Piezoelectric Speaker	Provides BIOS beep codes
O	National Semiconductor PC97307 I/O Controller	Provides serial and parallel ports, diskette drive, mouse, keyboard and IR interfaces
P	IDE Connectors	Each connector supports two IDE devices
Q	82371EB (PIIX4E)	Provides USB and power management support in addition to EIDE and UDMA/33 data transfer rates
R	PCI Bus Add-in Board Connectors	Support for 33 MHz PCI devices
S	ISA Bus Add-in Board Connector	Support for ISA compatible add-in cards

Microprocessor

The Intel® MS440GX motherboard supports one or two Pentium II Xeon 400 or 450 MHz processors, 100 MHz host bus speeds, and L2 caches up to 1MB in size. The processor's VID pins automatically program the voltage regulator on the motherboard to the required processor voltage for the Boot (P0) Processor only.

A plug-in VRM must be used when adding an Application (P1) Processor. If a plug-in VRM is not used, then the L2 cache will be disabled.

Processor Packaging

Each processor is packaged in a single edge contact cartridge (S.E.C.C.). The cartridge includes the processor core, second-level cache, thermal plate, and back cover.

The processor connects to the motherboard through the Slot 2 connector, a 330-pin edge connector. When mounted in a Slot 2 connector, the processor is secured by a retention mechanism attached to the motherboard.

Second Level Cache

The second-level cache is located on the substrate of the S.E.C.C.. The ECC cache includes components totaling up to 1 MB in size. All onboard system memory is cacheable.

Processor Options

The following processor configuration options can be used:

- A single 400 MHz processor installed in the boot processor slot (P0) and a terminator card installed in the application processor slot (P1). P0 is the Slot 2 connector closest to the middle of the board. See Figure 1 callouts F and G.
- Dual 400 MHz processors. When using two processors, a voltage regulator module (VRM) must be installed.
- A single 450 MHz processor installed in the boot processor slot (P0) and a terminator card installed in the application processor slot (P1).
- Dual 450 MHz processors. When using two processors, a voltage regulator module (VRM) must be installed. See Figure 21, callout D for the location of the VRM connector.

If you are installing two processors, then the following values must be identical for both:

- L2 cache size
- Operating voltages
- Processor speed

⚠ CAUTION

If the processor operating voltages for either VCC core or VCC L2 do not match, then the computer will not boot.

Use configure mode to set the processor speed if necessary.

Form Factor

The motherboard is designed to fit into a custom ATX form factor chassis.

The illustration below shows the board mounting hole locations. The mounting holes closest to the Slot 2 connectors are used for mounting the processor retention mechanism to the board and chassis.

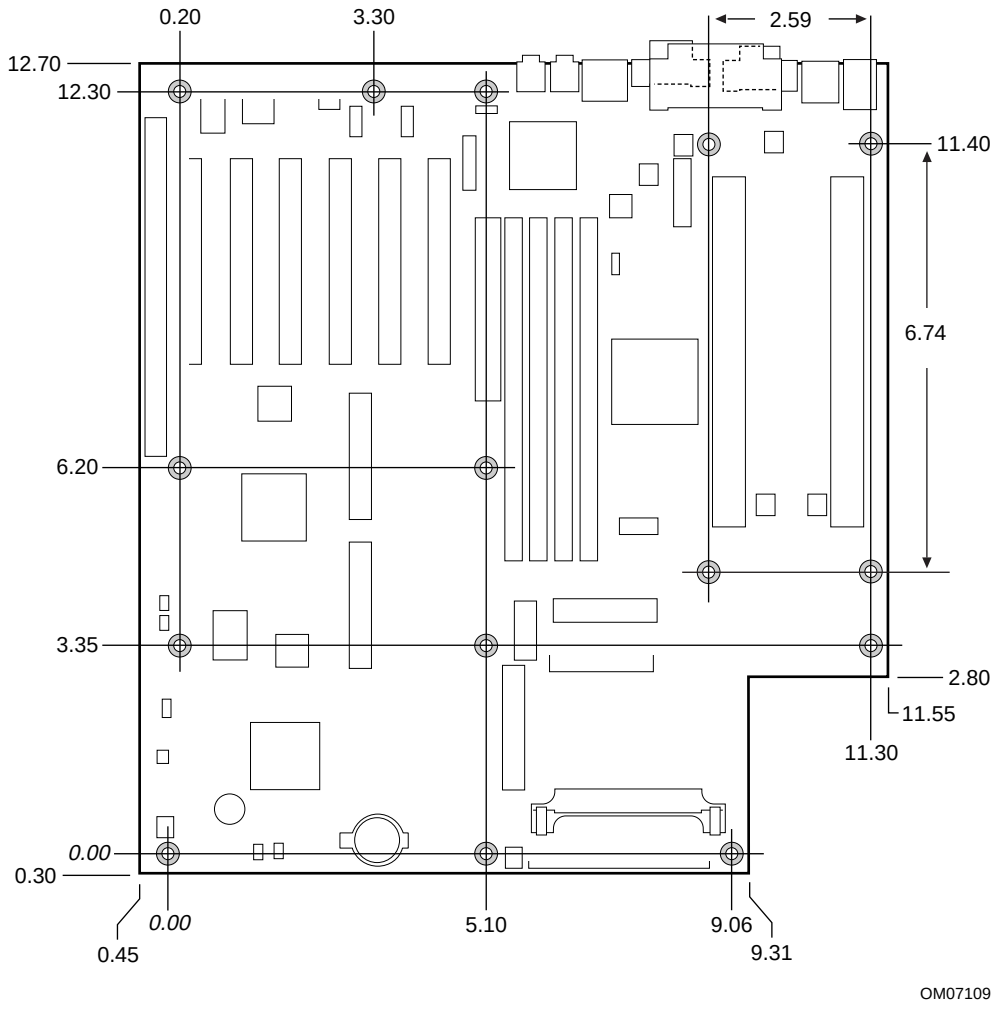


Figure 2. MS440GX Custom ATX Form Factor

Chipset

The Intel® 440GX AGPset includes a Host-PCI bridge integrated with both an optimized DRAM controller and an Accelerated Graphics Port (A.G.P.) interface.

The I/O subsystem of the 440GX is based on the PIIX4E which is a highly integrated PCI-ISA/IDE Accelerator Bridge. This chipset consists of the Intel 82443GX PCI/A.G.P. controller (PAC) and the Intel® 82371EB PCI/ISA IDE Xcelerator (PIIX4E) bridge chip.

82443GX PCI/A.G.P. Controller (PAC) (H)

The Intel 82443GX PCI/A.G.P. Controller (PAC) provides the following functions:

- Bus-control signals
- Address paths
- Data paths for transfers between the processor's host bus, PCI bus, the A.G.P., and main memory.

Table 2 lists the PAC features and the functionality each feature supports.

Table 2. PCI/A.G.P. Controller Features

Feature	Functionality
Processor Interface Control	Support for processor host bus frequencies of 100 MHz only 32-bit addressing Desktop optimized GTL + compliant host bus interface
Integrated DRAM Controller	+3.3V only DIMM DRAM configurations Up to four double sided DIMMs 100 MHz PC100-compatible Synchronous DRAM DIMM serial presence detect via SMBus interface 2-, 4-, 8-, 16-, 32-, 64-, and 128-Mbit DRAM devices SDRAM 64-bit data interface with ECC support Symmetrical and asymmetrical DRAM addressing
A.G.P. Interface	Complies with the A.G.P. specification Rev. 1.0 Support for +3.3V A.G.P. 66/133 MHz devices Synchronous coupling to the host-bus frequency
PCI Bus Interface	Complies with the PCI specification Rev. 2.1 Asynchronous coupling to the host-bus frequency PCI parity generation support Data streaming support from PCI-to-DRAM Support for six PCI bus masters in addition to the host PCI-to-ISA I/O bridge Support for concurrent host, A.G.P., and PCI transactions to main memory
Data Buffering	DRAM write buffer with read-around-write capability Dedicated host-to-DRAM, PCI0-to-DRAM, and PCI1/A.G.P.-to-DRAM read buffers A.G.P. dedicated inbound/outbound FIFOs (AGP2X), used for temporary data storage
Power Management Functions	Support for system suspend/resume and power-on suspend Compliant with ACPI power management
SMBus Support for Desktop Management Functions	
Support for System Management Mode (SMM)	

Intel® 82371EB Xcelerator (PIIX4E) (Q)

The Intel® PIIX4E is a multifunction PCI device implementing the PCI-to-ISA bridge, PCI IDE functionality, Universal Serial Bus (USB) host/hub function, and enhanced power management.

Table 3 lists the PIIX4E features and the functionality each feature supports.

Table 3. 82371EB Xcelerator Features

Feature	Functionality
Multifunction PCI-to-ISA Bridge	Support for the PCI bus at 33 MHz Complies with the PCI specification Full ISA bus support
USB Controller	Two USB ports Support for legacy keyboard and mouse Support for UHCI Design Guide, revision 1.1, interface
Integrated Dual Channel Enhanced IDE Interface	Support for up to four IDE devices PIO Mode 4 transfers at up to 16 MB/sec Support for Ultra DMA/33 synchronous DMA mode transfers up to 33 MB/sec Bus master mode with an 8x32-bit buffer for bus master PCI IDE burst transfers
Enhanced DMA Controller	Two 8237-based DMA controllers Support for PCI DMA with three PC/PCI channels and distributed DMA protocols Fast type-F DMA for reduced PCI bus usage
Interrupt Controller Based on 82C59	Support for 15 interrupts Programmable for edge/level sensitivity
Power Management Logic	Sleep/resume logic Support for Wake on Modem, Wake on LAN† technology, and Wake on PME Support for ACPI System wakes from ACPI sleep state with keyboard activity
Real-Time Clock	256-byte battery backed CMOS RAM Includes date alarm
16-bit Counters/Timers Based on 82C54	

Intel® 82093AA I/O Advanced Programmable Interrupt Controller (IOAPIC)

The Intel® 82093AA I/O Advanced Programmable Interrupt Controller (IOAPIC) provides interrupt management and incorporates both static and dynamic symmetric interrupt distribution across all processors in a multiprocessor system. The 82093AA IOAPIC features 24 interrupts as follows:

- 13 ISA interrupts
- Four PCI interrupts
- One Interrupt/SMI# rerouting
- Two motherboard interrupts
- One interrupt used for INTR input
- Three general purpose interrupts
- SCI BIOS supported steering

IDE Support

The motherboard has two independent bus-mastering IDE interfaces. These interfaces support PIO Mode 3, PIO Mode 4, ATAPI devices (e.g., CD-ROM), and Ultra DMA synchronous-DMA mode transfers. The BIOS supports logical block addressing (LBA) and extended cylinder head sector (ECHS) translation modes. The BIOS automatically detects the IDE device transfer rate and translation mode.

The motherboard supports LS-120 diskette technology through its IDE interfaces. LS-120 diskette technology enables users to store 120 MB of data on a single, 3.5-inch removable diskette. LS-120 technology is backward compatible (both read and write) with 1.44 MB and 720 KB DOS-formatted diskettes and is supported by Windows† 95 and Windows NT† operating systems.

The motherboard allows connection of an LS-120 compatible drive and a standard 3.5-inch diskette drive. If an LS-120 drive is connected to an IDE connector and configured as the A drive, and a standard 3.5-inch diskette drive is configured as a B drive, the standard diskette drive must be connected to the diskette drive cable's "A" connector (the connector at the end of the cable). The LS-120 drive can be configured as a boot device, if selected in the BIOS setup utility.

Real-Time Clock, CMOS RAM, and Battery

The real-time clock provides a time-of-day clock and a multicentury calendar with alarm features and century rollover.

The clock is compatible with DS1287 and MC146818 components and it supports 256 bytes of battery-backed CMOS RAM in two banks that are reserved for BIOS use.

The time, date, and CMOS values can be specified in the Setup program. The CMOS values can be returned to their defaults by using the Setup program.

An external coin-cell battery powers the real-time clock and CMOS memory. When the computer is not plugged into a wall socket, then the battery has an estimated life of three years. When the computer is plugged in, then the 3 V standby current from the power supply extends the life of the battery.

NOTE

Power is supplied to the chassis intrusion circuit by the battery when no AC power is provided. Chassis intrusion will be detected when no AC power is available to the system. If the switch is activated when no AC power is provided, then the drain on the battery is approximately 200 mA.

The clock is accurate to ± 13 minutes/year at 25 ºC with 5 V applied.

Diskette Drive Controller

The diskette drive controller is software compatible with the DP8473 and N82077 diskette drive controllers and supports both PC-AT† and PS/2† modes. In the Setup program, the diskette drive interface can be configured for the following diskette drive capacities and sizes:

- 360 KB, 5.25-inch
- 1.2 MB, 5.25-inch
- 720 KB, 3.5-inch
- 1.2 MB, 3.5-inch (driver required)
- 1.25/1.44 MB, 3.5-inch

Accelerated Graphics Port (A.G.P.) Support

The Accelerated Graphics Port (A.G.P.) is a high-performance interconnect for graphic-intensive applications, such as 3D applications.

A.G.P. is independent of the PCI bus. It is intended for exclusive use with graphical display devices. A.G.P. provides these performance features:

- Pipelined-memory read and write operations that hide memory access latency
- Demultiplexing of address and data on the bus for near 100 percent bus efficiency
- AC timing for 133 MHz data transfer rates, allowing data throughput of 528 MB/sec

An A.G.P. connector is provided on the motherboard to install A.G.P. add-in cards.

Memory

The motherboard has four dual inline memory module (DIMM) sockets.

Minimum memory size is 32 MB; maximum memory size is 2 GB. The BIOS automatically detects memory type and size.

The motherboard supports the following memory features:

- PC100 compliant 168-pin DIMMs with gold-plated contacts
- 3.3 V unbuffered or registered (not mixed) 100 MHz ECC SDRAM DIMMs only
- Single or double sided DIMMs in the sizes listed in the Table 4.

Table 4. DIMM Sizes Supported

DIMM Size	Configuration
16 MB	2 Mbit x 72
32 MB	4 Mbit x 72
64 MB	8 Mbit x 72
128 MB	16 Mbit x 72
256 MB	32 Mbit x 72
512 MB	128 Mbit x 72

Memory can be installed in any order in one, two, three or four sockets.

Memory size can vary between sockets.

Memory speed is 100 MHz only.

Input/Output (I/O) Controller (O)

The I/O controller handles the exchange of information between the processor and external devices like the mouse and keyboard or a printer that are connected to the computer.

The National Semiconductor PC97307 I/O Controller is an ISA Plug and Play compatible multifunction I/O device with components and features listed in the table below.

Table 5. I/O Controller Components

Component	Feature(s)
Serial Ports	Two 16450/16550A software compatible UARTs Internal send/receive 16-byte FIFO buffer Four internal 8-bit DMA options for the UART with SIR support (USI)
Multimode Bidirectional Parallel Port	Standard mode: IBM and Centronics compatible Enhanced parallel port (EPP) mode with BIOS and driver support High speed extended capabilities port (ECP) mode
Diskette Drive Controller	DP8473 and N82077 compatible 16-byte FIFO buffer PS/2 diagnostic-register support High performance digital data separator (DDS) PC-AT, PS/2, and 3 mode diskette drive mode support
8042A Compatible Keyboard and Mouse Controller	
Support for IrDA† and Consumer Infrared Compliant Infrared Interface	

By default, the I/O controller interfaces are automatically configured during boot up. The I/O controller can also be manually configured in the Setup program.

82558 PCI LAN Controller (D)

The Intel 82558 LAN Controller provides the functions listed in Table 6 below.

Table 6. LAN Controller Functions

Function	Includes:
CSMA/CD Protocol Engine	
PCI bus interface (Rev 2.1 compliant)	
DMA engine for movement of commands, status, and network data across the PCI bus	
Integrated physical layer interface	Complete functionality necessary for the 10Base-T and 100Base-TX interfaces When in 10 Mbit/sec mode, the interface drives the cable directly A complete set of MII management registers for control and status reporting 802.3µ Auto-Negotiation for automatically establishing the best operating mode when connected to other 10 Base-T or 100Base-TX devices
Integrated power management features	Support for ACPI Support for Wake on LAN technology
Digitally controlled adaptive equalizations and transmission	

EtherExpress™ PRO/100 WfM PCI LAN Subsystem

The Intel EtherExpress PRO/100 Wired for Management (WfM) PCI LAN subsystem is an Ethernet LAN interface that provides both 10Base-T and 100Base-TX connectivity. Features include:

- 32-bit direct bus mastering on the PCI bus
- Shared memory structure in the host memory that copies data directly to/from host memory
- 10Base-T and 100Base-TX capability using a single RJ-45 connector
- IEEE 802.3µ Auto-Negotiation for the fastest available connection

Alert On LAN Component

The Alert on LAN component is a companion device to the Intel 82558 LAN controller. Together, these devices provide a management interface between a remote management console (or management server) and a client system monitoring instrumentation.

When an alert input is asserted, the Alert on LAN component transmits Ethernet† packets to the 82558 through an 8-bit dedicated data path. Examples of events that can trigger alert messages to a management server include:

- Chassis intrusion
- System BIOS hang (transmits POST code error)
- LAN leash (transmits an alert that the LAN cable was disconnected)
- Temperature out of specification
- Fan failure

For more information on the Alert on LAN component and its network management capabilities, contact your local Intel sales office.

Audio Subsystem

The optional onboard audio subsystem features the Crystal CS4235, an audio codec with an integrated FM synthesizer.

The audio subsystem provides all the digital audio and analog mixing functions needed for recording and playing sound on personal computers. The audio subsystem contains the following features:

- Stereo analog-to-digital and digital-to-analog converters
- Analog mixing, anti-aliasing, and reconstruction filters
- Line and microphone level inputs
- ADPCM, A-law, or µlaw digital audio compression/decompression
- Full digital control of all mixer and volume control functions
- High-quality, 16-bit, MPC-II compliant onboard audio
- Full duplex operation
- AdLib†, Sound Blaster Pro† 2.0, Windows Sound System, and MPU-401 support
- Full DOS games compatibility
- MIDI/Game port support
- OPL3 compatible FM synthesizer
- BIOS Setup-based enable/disable

The audio subsystem requires up to two DMA channels and one IRQ. Table 7 shows the IRQ, DMA channel, and base I/O address options. These options are automatically chosen by the Plug and Play interface, so there are no default settings.

Table 7. Audio Subsystem Resources

Resource	IRQ (Options)	DMA Channel (Options)	I/O Address (Options)
Sound Blaster† (DMA playback, DMA / IRQ shared with Windows Sound System capture)	5 best choice 7 9 best choice 11	0 best choice 3	210-21Fh 220-22Fh best choice 230-234h 240-24Fh 250-25Fh 260-26Fh
Windows Sound System (DMA playback)	7 9 best choice 11	0 1 best choice 3	534-537h best choice 608-60Bh
MPU-401 (IRQ shared with Sound Blaster)	5 best choice 7 9 best choice 11		300-301h 330-331h best choice 332-333h 334-335h
MIDI			200-207h
FM Synthesis			388-38Dh
CS4235 Control			FF0-FFFh

Audio Drivers and Utilities

Audio software and utilities are available from Intel's World Wide Web site. Audio driver support is provided for the Microsoft Windows NT 4.0 and Microsoft Windows 98 operating systems.

Hardware Monitor Subsystem

The hardware monitor subsystem provides low-cost instrumentation capabilities. The features of the hardware monitor subsystem include:

- Management Level 4 functionality
- Analog Devices ADM 9240 or equivalent.
  - — Integrated temperature and voltage monitoring to detect levels above or below acceptable values (+12 V, -12 V, +5 V, +3.3 V, and +2.5 V). When suggested ratings for temperature, fan speed or voltage are exceeded, an interrupt is activated.
  - — Two fan speed sensors
  - — Access through the SMBus
- Remote reset capabilities from a remote peer or server through LANDesk® 3.3 (or later) Client Manager and service layers
- Headers for front and rear chassis intrusion connectors.

Power Supply

Table 9 lists the power specifications for a computer that contains a motherboard with two 400 MHz Pentium II Xeon processors, 128 MB SDRAM, a 3.5-inch diskette drive, an WD Caviar 3320 3.3 GB Ultra ATA hard drive, a Hitachi CPR 8330 IDE CD-ROM, and a Diamond Viper 330 A.G.P. graphics card. This information is provided only as a guide for calculating approximate power usage with additional resources added.

Values for the Windows 98 desktop mode are measured at 1280x1024x256 colors and 70 Hz refresh rate. AC watts are measured with a typical 300 W supply, nominal input voltage and frequency, with true RMS wattmeter at the line input.

Table 8. Power Usage

Mode	Watts (AC) Out of AC Wall Outlet
Windows 98 desktop	60 watts
Windows NT 4.0 desktop	92 watts

Power Supply Considerations

For typical configurations, the motherboard is designed to operate with at least a 300 W power supply. A higher-wattage power supply should be used for heavily-loaded configurations. The power supply must comply with the following recommendations:

- The potential relation between 3.3 V DC and +5 V DC power rails
- The current capability of the +5 VSB line
- All timing parameters
- Must meet UL SELV requirements and meet the 240VA energy limit

Table 9. DC Voltage Tolerances and Estimated Current Requirements (no PCI or A.G.P. shown)

DC Voltage	Acceptable Tolerance	Estimated current with a 400 MHz processor, 512 KB cache, and 2 GB RAM	Estimated current with a 450 MHz processor, 512 KB cache, and 2 GB RAM
+3.3 V	± 5%	20A	20A
+5 V	± 5%	14A	16A
+5 VSB (standby)	± 5%	0.72A	0.72A
-5 V	± 10%	0.0A	0.0A
+12 V	± 5%	2.8A	3.1A
-12 V	± 10%	0.0A	0.0A

NOTE

Some heavily loaded configurations could require additional +3.3 V and +5 V power for peripherals. Use the auxiliary power supply connector for this purpose.

Expansion

The MS440GX motherboard has seven expansion slots for installing add-cards such as video or network cards that expand the capabilities of your computer.

The expansion slots available are as follows:

- Five PCI slots
- One shared slot (for a PCI or ISA card)
- One AGP 2X slot

Basic Input/Output System (BIOS)

The MS440GX motherboard uses an Intel/Phoenix BIOS which is stored in flash memory. The BIOS can be upgraded using a disk-based program.

The contents of flash memory includes the following items:

- BIOS
- Setup Program
- Power-on Self Test (POST)
- Advanced Power Management (APM)
- PCI Auto-configuration Utility
- Windows 98-ready Plug and Play Code

The MS440GX motherboard supports system BIOS shadowing, allowing the BIOS to execute from 64-bit onboard write-protected DRAM.

During POST, the BIOS displays a message identifying the type of BIOS and the revision code. The initial production BIOS is identified as 4M4SG0X0.86E.

BIOS Upgrades

NOTE

Please review the instructions distributed with the upgrade before attempting a BIOS upgrade.

The BIOS can be upgraded from a diskette using the Intel Flash Memory Update utility that is available from Intel. This utility does BIOS upgrades as follows:

- Updates the flash BIOS from a file on a disk
- Updates the language section of the BIOS
- Makes sure that the upgrade BIOS matches the target system to prevent accidentally installing a BIOS for a different type of system.

BIOS upgrades and the update utility are available from Intel through the Intel World Wide Web site.

Chapter 4 details the procedure for executing a BIOS upgrade.

BIOS Flash Memory Organization

The Intel E28F004BXT80 4-Mbit flash component is organized as 512 KB x 8 bits and is divided into areas as described in Table 10. The table shows the addresses in the ROM image in normal mode (the addresses change in BIOS Recovery Mode).

Table 10. Flash Memory Organization

Address (Hex)	Size	Description
FFFFC000 - FFFFFFFF	16 KB	Boot Block
FFFFA000 - FFFFBFFF	8 KB	Vital Product Data (VPD) Extended System Configuration Data (ESCD) (DMI configuration data / Plug and Play data)
FFFF9000 - FFFF9FFF	4 KB	Used by BIOS (e.g., for Event Logging)
FFFF8000 - FFFF8FFF	4 KB	OEM logo or Scan Flash Area
FFF80000 - FFFF7FFF	480 KB	Main BIOS Block

Piezoelectric Speaker (N)

The onboard piezoelectric speaker is enabled by a jumper on pins 1 and 2 of the front panel connector.

The onboard speaker can be disabled by removing the jumper. An outboard speaker can be connected in its place by a jumper on pins 1 and 4.

This speaker provides error beep code information during the POST in the event that the computer cannot use the video interface. The speaker is not connected to the audio subsystem and does not receive output from the audio subsystem.

2 Installation and Removal Procedures

This chapter explains how to remove and install the MS440GX motherboard and its various component parts. The chapter covers the following topics:

Topic or Procedure	Page
Safety Considerations	30
How to Install the Processor Retention Mechanism	30
How to Install a Single Processor	37
How to Install a Second Processor	38
How to Remove and Install the Motherboard	40
How to Set Processor Speed	41
Jumper Settings	42
How to Remove a Processor	43
How to Upgrade a Processor	44
How to Install the Termination Card	45
How to Remove the Termination Card	46
How to Install Memory	47
How to Remove Memory	48
How to Replace the Battery	49
How to Clear Passwords	51

Safety Considerations

⚠ CAUTION

Before *removing or installing the motherboard or any other system component, observe the following safety guidelines:*

See Appendix B: Regulatory & Integration Information for safety requirements and precautions.

Always follow the steps in the procedure in the correct order (i.e., as written).

Set up a log to record identification information about your computer.

Wear an antistatic wrist wrap and place the motherboard on a conductive foam pad when working on it.

⚠ WARNINGS

The procedures in this section assume that you are familiar with the general terminology associated with personal computers and with the safety practices and regulatory compliance required for using and modifying electronic equipment including but not limited to the following:

Turn off system AC power by unplugging the AC power cord from the wall outlet. Disconnect the computer from any telecommunications systems, networks, and modems attached before performing any of the procedures described in this section else personal injury or equipment damage can result.

⚠ CAUTION

Electrostatic discharge (ESD) can damage components. Therefore, protect against electrostatic discharge (ESD) by performing the procedures described in this section only at an ESD workstation or by wearing an antistatic wrist wrap and attaching it to a metal part of your computer's chassis.

How to Install the DRM Fans and Processor Retention Mechanism

NOTES

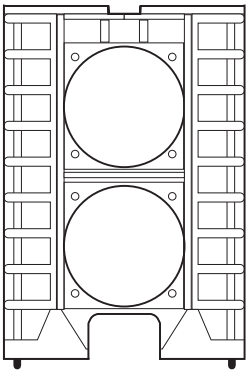
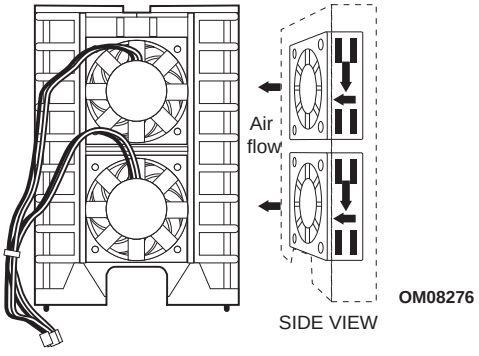
Dual Retention Mechanism (DRM) fans must be installed in the DRM end stands prior to installing the processor retention mechanism on the motherboard.

The following procedure table combines the fan installation and processor retention mechanism installation procedures.

Materials Required:

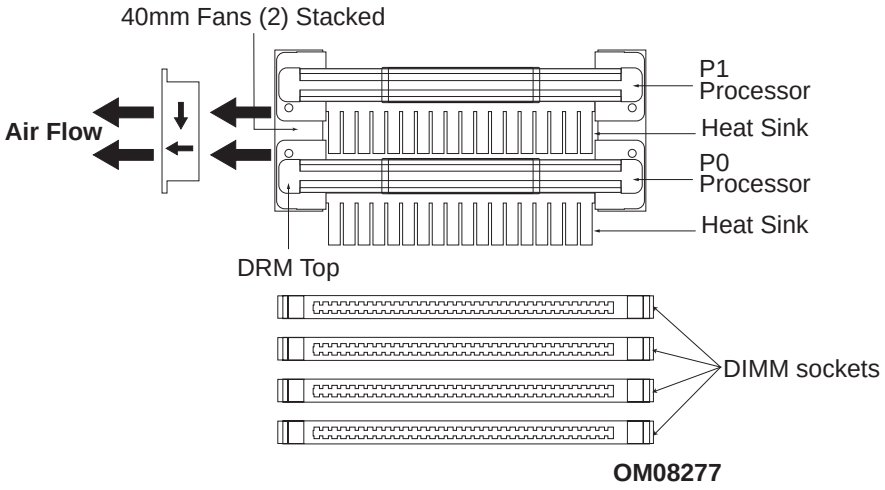
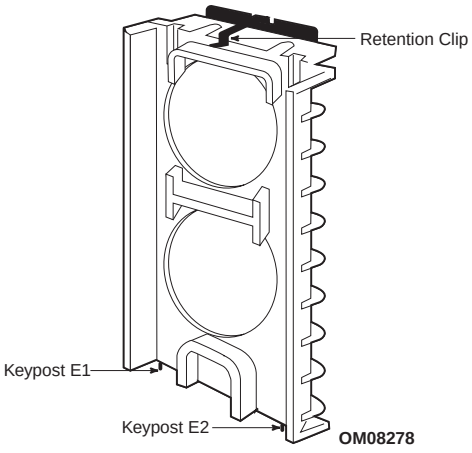
- 2 40mm fans
- 2 DRM stands (see Figure 3)
- 4 Fan screws (P/N 656880-002)
- 2 DRM tops (see Figure 3f)
- 2 Processors (CPUs) with attached heatsinks (see Figure 3g)
- 2 Retention clips (see Figure 3c)
- 1 Small tie wrap

Procedure To: Install DRM Fans and the Processor Retention Mechanism

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Obtain one of the DRM stands.  OM08275 **Figure 3.**
3	Place the two Delta 40mm fans in the DRM stand pocket. Position the fans with air flow away from the DRM.  OM08276 **Figure 3a.**

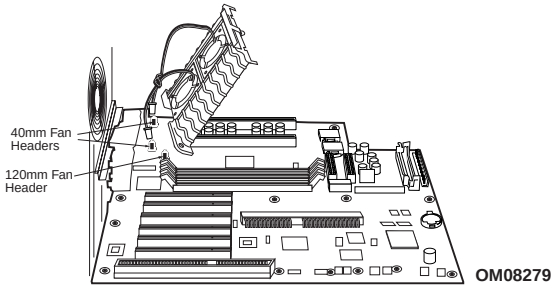
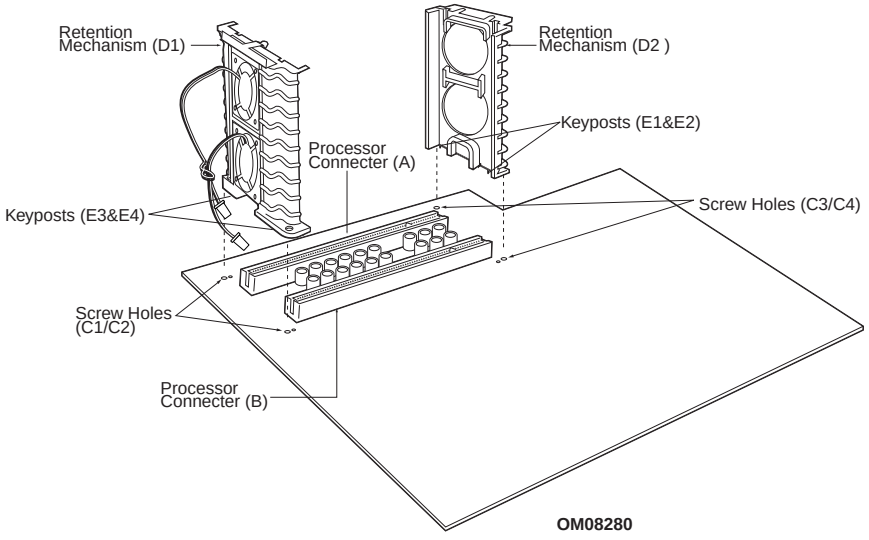
Continued

Procedure (continued)

Step	Action
4	Orient power cables to the upper left corner as illustrated in Step 3.
4a	Run the power cables down the left side of the DRM base as illustrated in Step 3.
4b	Tie wrap the cables leaving approximately 2 inches of cable hanging beyond the base.
5	Attach fans in the DRM stand with 2 fan screws placed in opposite corners. Position the fans with air flow away from the DRM.  **Figure 3b.** IF more air flow is needed, then position 2 fans in the other DRM stand and secure them with air flow into (towards) the DRM.
6	Apply a retention clip to the tops of the DRM bases.  **Figure 3c.**

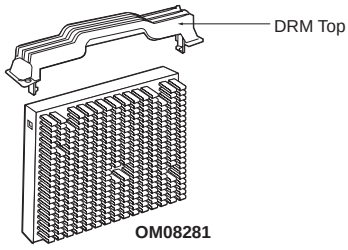
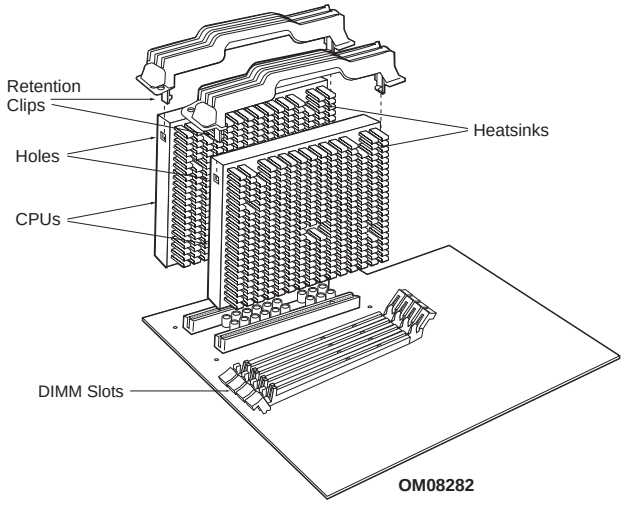
Continued

Procedure (continued)

Step	Action
7	Take the DRM base with 40mm fans attached and connect the two fans to the processor fan headers on the motherboard.  **Figure 3d.**
8	Locate the Slot 2 processor connectors (A and B) and the four attachment screw holes (C1-C4) shown in Figure 3e.
9	Properly position the processor retention mechanisms (D1 and D2) relative to the Slot 2 connectors.
10	Fit the keyposts (Step 6 illustration, callouts E1 and E2) on the processor retention mechanisms into the holes in the motherboard base. When properly seated, the bases of the processor retention mechanism should fit flush with the motherboard.
11	Mount the DRM base to the motherboard with fan air flow pointing toward the back of the chassis.
11a	Use four 6-32x1/2 or 5/8 inch screws (chassis dependent) to attach DRM bases to motherboard. Torque screws to 6 inch pounds.  **Figure 3e.**

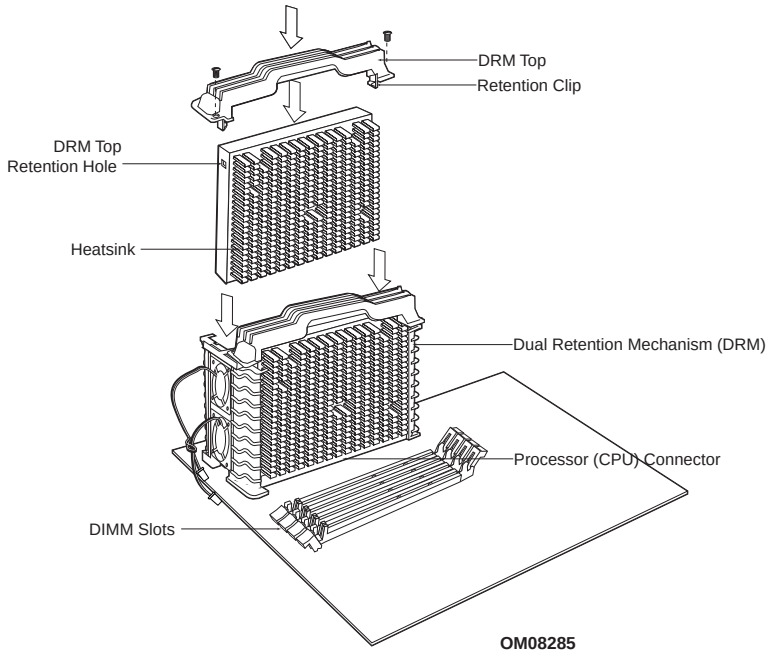
Continued

Procedure (continued)

Step	Action
12	Assemble the other DRM base, mount it on the other side of the Slot 2 connectors with 1/2 or 5/8 inch screws (chassis dependent).
13	Obtain the CPU/Heat sinks and the DRM tops.  **Figure 3f.**
14	Secure one of the DRM tops to the processor with the holes facing toward the DIMM sockets on the motherboard. **NOTE** *The DRM tops snap into two recesses on the sides of the processor.*  **Figure 3g.**

Continued

Procedure (continued)

Step	Action
15	Secure the other DRM top to the processor with the holes facing toward the DIMM slots. **NOTE** *If using a Termination Card, then secure the DRM top to the card in the same manner.* The DRM top is necessary to lock the Termination Card down and provide a way to remove it from the connector by pulling it up and out.
16	Install the two processors (CPUs) in the DRM with the heat sinks facing the DIMM slots. **NOTE** *Check hole placement of the DRM top relative to the retainer clip holes before installation to ensure correct alignment. Use 4 ½ inch screws to secure tops to retainer clip.*  **Figure 3h.**

Continued

Procedure (continued)

Step	Action
17	The final fan/CPU-heat sink/DRM assembly should appear as shown in the illustration below.

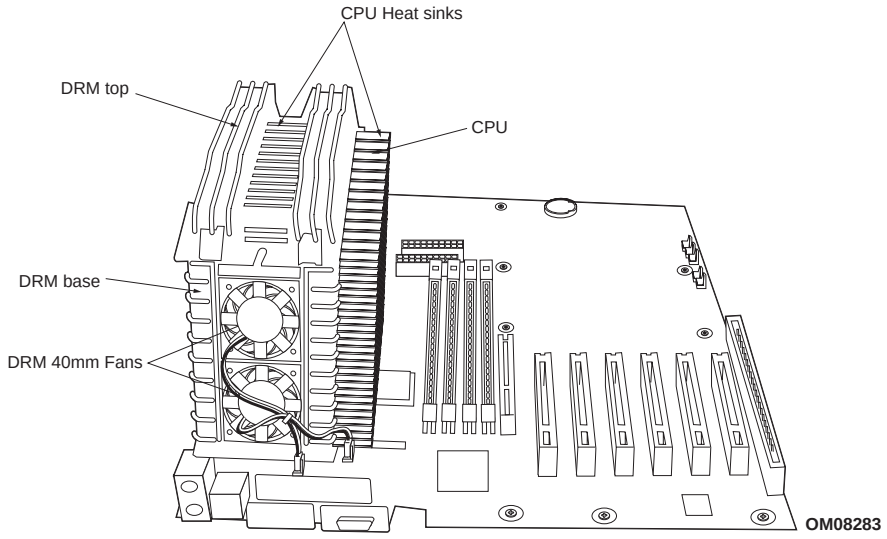
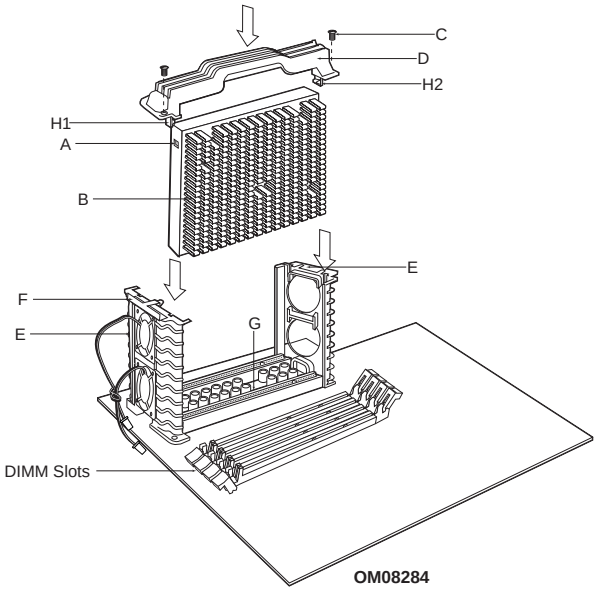


Figure 3i.

How to Install a Single Processor

Procedure To: Install a Single Processor

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove any peripherals that block access to the P0 processor's Slot 2 connector.
5	Remove the antistatic packaging from the new processor.
6	Secure a DRM top (D) to the processor by snapping the clips (H1 and H2) into the holes on each side of the processor.
7	Orient the P0 processor (A) so that the heat sink (B) is closest to the DIMM sockets.
8	Slide the processor into the retention mechanism (E).  **Figure 4.**
9	Press down firmly on the processor until it is seated in the P0 processor Slot 2 connector (G) and fasten with screws.
10	Lock down DRM top into retainer clips (F) on tops of DRM bases with 6-32x1/2 inch screws (C).
11	If there is no Termination Card in the P1 processor Slot 2 connector then install one using the procedure entitled "How to Install a Termination Card".
12	Replace any peripheral equipment that was removed in Steps 3 and 4 above.
13	Set the processor speed using the procedure entitled "How to Set the Processor Speed".

How to Install a Second Processor

⟹ NOTE

It may be necessary to reload the operating system to realize optimum performance when upgrading from a single processor to a dual processor configuration.

If installing two processors, then the following values must be identical for both processors:

L2 cache size and type (ECC); Operating voltages; Bus and Core frequencies.

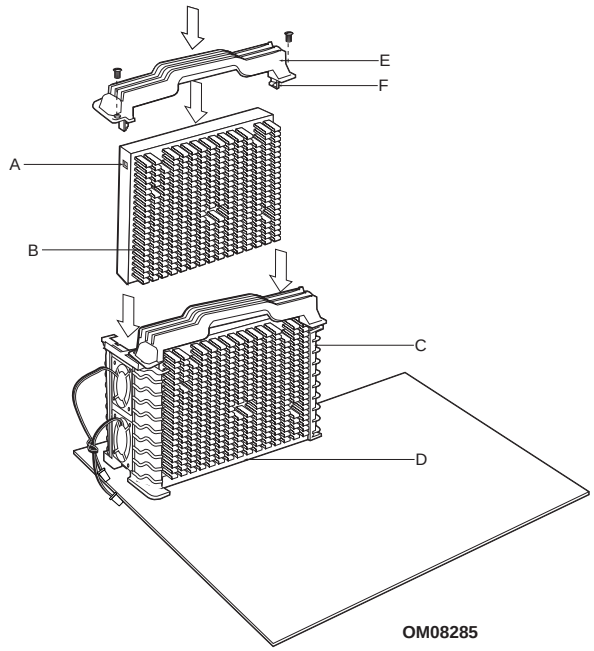
The core stepping value may differ by one step (eg., C0 to C1). These values may be determined by checking the parameters of the s-spec number, a five character code (eg., SL28R) printed on the top edge of the S.E.C.C.. For information about s-spec parameters, refer to the Pentium II processor quick reference guide at the Intel developer's web site.

Procedure To: Install a Second Processor

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment and remove any peripherals that block access to the P1 processor Slot 2 connector.
4	If there is a Termination Card installed in the P1 processor Slot 2 connector then remove it using the procedure entitled "How to Remove a Termination Card".
5	Remove the antistatic packaging from the second processor.
6	Secure a DRM top (E) to the processor by snapping the clips (F) into the holes on each side of the processor.
7	Orient the P1 processor (A) so that the heat sink (B) faces the DIMM slots.

Continued

Procedure (continued)

Step	Action
8	Slide the processor into the processor retention mechanism (C).  **Figure 5.**
9	Press down firmly on the processor until it is seated in the P1 Slot 2 connector (D) and fasten with screws.
10	Replace any peripheral equipment that was removed in Step 3 above.
11	Set the processor speed using the procedure entitled “How to Set the Processor Speed”.

How to Remove and Install the Motherboard

Refer to your chassis manual for detailed instructions on removal and installation.

WARNING

Motherboard removal or installation should be done only by qualified technical personnel. Disconnect the computer from its power source before performing the removal or installation procedures noted here and before opening the computer. Failure to observe these precautions may result in personal injury or equipment damage.

Procedure To: Remove the Motherboard

Step	Action
1	Remove processor/heatsink/DRM assembly/Termination Card (if applicable) using procedures "How to Remove a Processor" and "How to Remove a Termination Card".
2	Remove the four screws attaching the DRM bases to the chassis.
3	Disconnect fan cables from fan headers
4	Locate the motherboard mounting screw holes in Figure 6 below.
5	Remove the 11 motherboard mounting screws.
6	Carefully extract the board by its edges.
7	Place board component-side up on a grounded, static free surface.

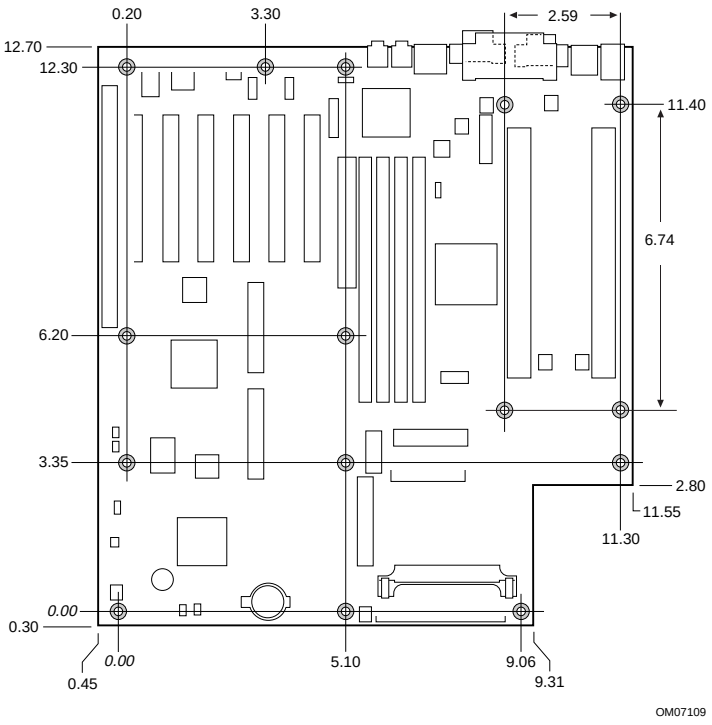


Figure 6. Motherboard Mounting Screw Holes

How to Set Processor Speed

⚠ CAUTION

Selecting a processor speed greater than the rated speed of the installed processor(s) may damage the processor(s).

Set processor speed after you have installed or upgraded the processor.

The procedure that follows assumes that:

- The computer is turned OFF
- The cover has been removed
- The configuration jumper block (J4J1) has the jumper set on pins 1-2 for normal mode

Procedure To: Set Processor Speed

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Locate the configuration jumper block (see figure below).
3	Move the jumper to pins 2-3.
4	Replace the computer cover.
5	Turn ON the computer.
6	Allow the computer to boot up.
7	The computer starts the Setup Program.
8	Setup displays the Maintenance Menu.
9	Select the Processor Speed feature using the arrow keys.
10	Press the <ENTER> key.
11	Setup displays a pop-up screen with available processor speeds.
12	Select a speed using the arrow keys. (Choose 400 for a 400 MHz processor). ⚠ **CAUTION** *Do not exceed the rated speed or damage to the processor may result.*
13	Press the <ENTER> key to confirm the speed.
14	The Maintenance Menu is re-displayed.
15	Press <F10> to save the current values then Exit Setup.
16	Turn OFF the computer.
17	Remove the computer cover.
18	Move the jumper back to pins 1-2 on the jumper block (J4J1) to restore normal operation.
19	Replace the cover.
20	Turn ON the computer.
21	Verify the processor speed in the startup information displayed by the BIOS.

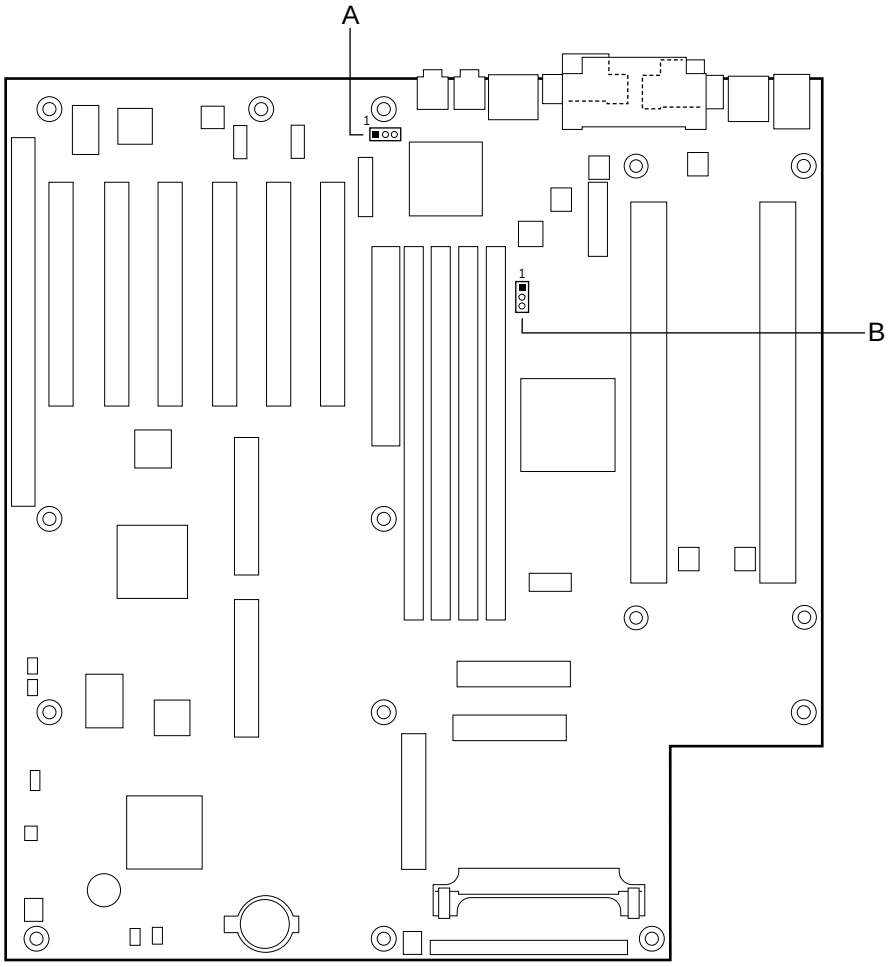
Jumper Settings

CAUTION

Do not move jumpers with the power ON. Always turn OFF the power and unplug the power cord from the computer before changing jumpers.

NOTE

There is no jumper setting for configuring the processor speed or bus frequency. The feature for configuring the processor speed is in the Setup program using configure mode.



A LAN enable/disable jumper block

B BIOS Setup configuration jumper block

Figure 7. Configuration Jumper Block

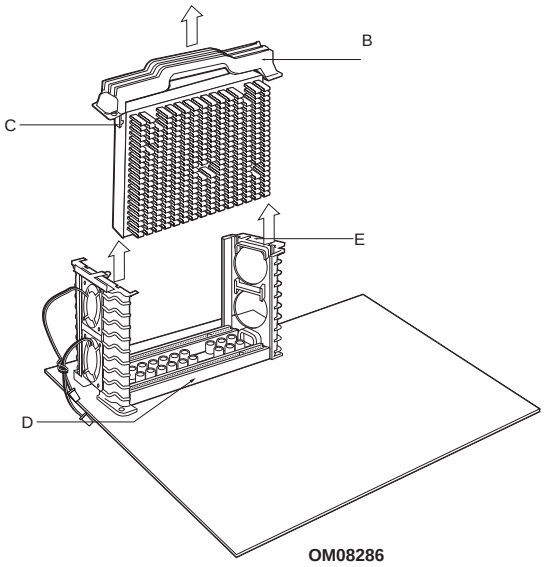
Table 11 describes the settings of the BIOS Setup configuration jumper block.

Table 11. BIOS Setup Configuration Jumper Settings

Mode	Jumper Setting	Description
Normal	1-2	The BIOS uses current configuration information and passwords for booting. **(Default)**
Configure	2-3	After the POST runs, Setup runs automatically. The maintenance menu is displayed.
Recovery	Off (jumper removed)	The BIOS attempts to recover the BIOS from a diskette. A recovery diskette is required.

How to Remove a Processor

Procedure To: Remove a Processor

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove any peripherals that block access to the processor.
5	Remove the screws from the DRM top (B)
6	Remove the processor (C) from the Slot 2 connector (D) by pulling the processor vertically upward as shown by the arrows in the illustration below. **NOTE** *Do not rock the processor (CPU) out of the DRM (E).*  **Figure 8.**
7	Store the processor in an antistatic package.

How to Upgrade a Processor

NOTES

If your motherboard has one microprocessor, then you can upgrade the computer by replacing this processor with a faster one or by installing an application processor.

If your motherboard has two microprocessors, then you can upgrade by replacing these processors with two faster processors.

If your operating system supports single processors only (such as Windows 95), then use the sequence of procedures listed under "Upgrading a Single Processor".

If your operating system supports dual-processing capability (such as Windows NT or UNIX†) and you will be running software programs that require additional processing power, then use the sequence of procedures listed under "Upgrading from Single to Dual Processors".

If your computer has two microprocessors and you want more processing power, then use the sequence of procedures listed under "Upgrading Dual Processors".

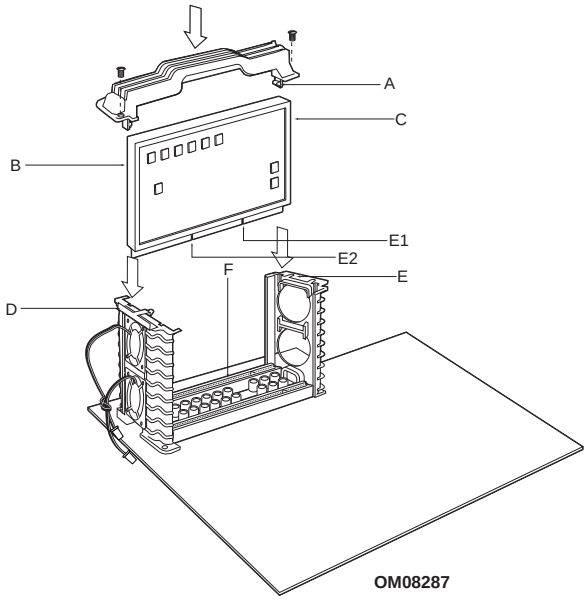
If you install only one processor on a motherboard, then it must go in the boot (P0) processor connector. In a single processor configuration, you must install a Termination Card in the empty application (P1) processor connector to ensure proper operation of the computer.

Procedure Reference Table

To Upgrade	Use Procedures
a Single Processor	How to Remove a Processor How to Install a Single Processor How to Set Processor Speed
from Single to Dual Processors	How to Remove the Termination Card How to Install a Second Processor How to Set Processor Speed
Dual Processors	How to Remove a Processor How to Install a Single Processor How to Install a Second Processor How to Set Processor Speed

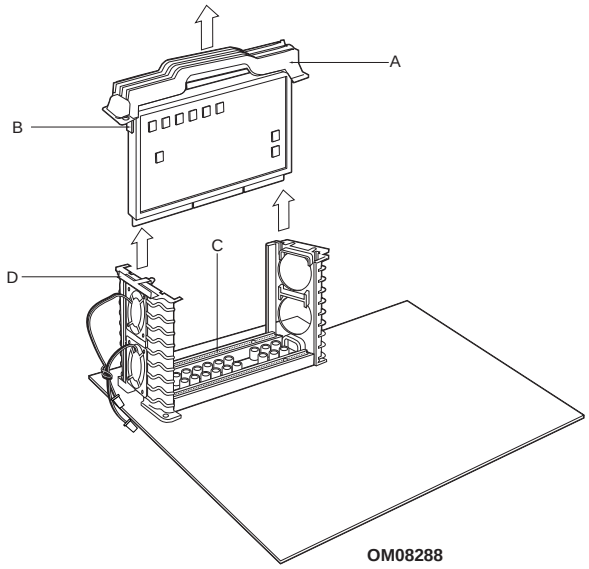
How to Install the Termination Card

Procedure To: Install the Termination Card

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove any peripherals that block access to the processor Slot 2 connector.
5	Remove the screws from the DRM top as shown in Figure 9 below.
6	Secure a DRM top (A) to the Termination Card (B) by snapping the clips (C) into the holes (or slots) in each side of the Card.
7	Slide the Termination Card (B) into the Retention Mechanism (D).
8	Ensure that the alignment notches (E1 and E2) in the Termination Card fits over the key in the P1 Processor Slot 2 connector (F) shown in the illustration below.  **Figure 9.**
9	Press down firmly on the Termination Card until it is seated in the P1 slot connector. **NOTE** *A Termination Card will never be used in the P0 slot connector.* Fasten the DRM cap into place with screws as shown in Figure 9 above.

How to Remove the Termination Card

Procedure To: Remove the Termination Card

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove any peripherals that block access to the processor Slot 2 connector.
5	Remove the two screws holding the DRM Top over the P1 slot Termination Card.
6	Using the DRM top (A) as a handle, lift the Termination Card (B) up and out of the processor Slot 2 connector (C) and the processor retention mechanism (D) as shown by the arrows in the illustration below. **NOTE** *Do not rock the Termination Card out of the connector - pull vertically upward.*  **Figure 10.**

How to Install Memory

NOTE

You can install from 32 MB to 2 GB of 100 MHz SDRAM in the motherboard DIMM sockets.

Memory can be installed in one, two, three or four sockets.

DIMM size can vary between sockets.

The MS440GX motherboard supports the following types of memory:

- 168-pin 3.3V DIMMs with gold-plated contacts
- Single or double-sided DIMMs (See Table 4)
- 100 MHz SDRAM

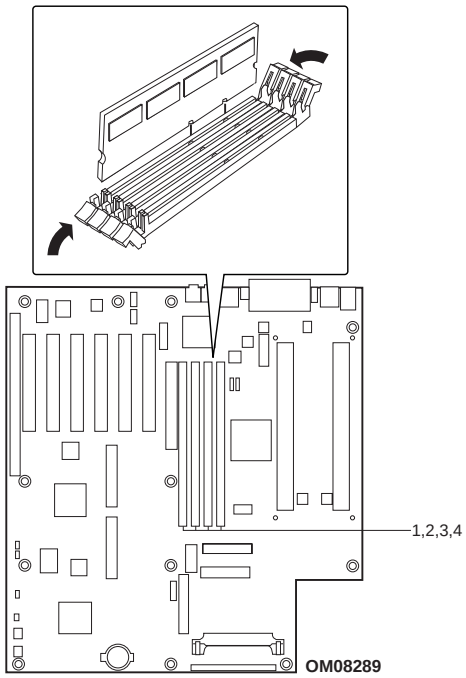
DIMM socket locations are shown in Figure 1/Callout I.

Procedure To: Install DIMMs

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Disconnect the computer's power cord and all external peripheral equipment.
3	Remove the computer cover and locate the DIMM sockets.
4	Holding the DIMM by its edges, remove it from its antistatic package.
5	Ensure that the clips at either end of the socket are pushed away from the socket.

Continued

Procedure (continued)

Step	Action
6	Position the DIMM above the socket and align the two small notches in the bottom edge of the DIMM with the keys in the socket.  **Figure 11.**
7	Insert the bottom edge of the DIMM into the socket.
8	When the DIMM is seated, then press down on the top edge of the DIMM until the retaining clips at the ends of the socket snap into place.
9	Make sure that the clips are firmly in place.
10	Replace the computer cover.

How to Remove Memory

Procedure To: Remove DIMMs

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove the computer cover and locate the DIMM sockets (See Figure 1/ Callout I).
5	Gently spread the retaining clips at each end of the socket.
6	The DIMM pops out of the socket.
7	Holding the DIMM by its edges, lift it away from the socket and store it in an antistatic package.

How to Replace the CR2032 Lithium Battery (M)

When your computer is turned off, a lithium battery maintains the current time-of-day clock and the current values in CMOS RAM.

The battery should last about seven years. When the battery begins to fail, it loses voltage; when the voltage drops below a certain level, the Setup program settings stored in CMOS RAM (for example, the date and time) might not be accurate. Replace the battery with an equivalent one.

WARNING

Danger of explosion if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Discard used batteries according to manufacturer's instructions.

ATTENTION

Il y a danger d'explosion s'il y a remplacement incorrect de la batterie. Remplacer uniquement avec une batterie du méme type ou d'un type recommandé par le constructeur. Mettre au rébut les batteries usagées conformément aux instructions du fabricant.

ADVARSEL!

Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

ADVARSEL

Lithiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

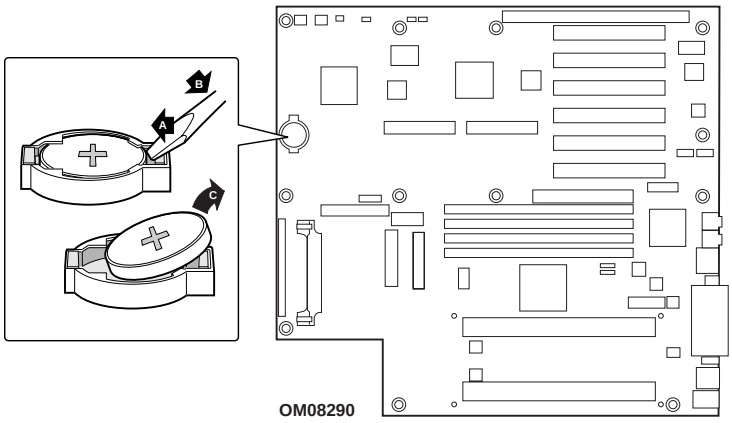
VARNING

Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

VAROITUS

Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käjtetty paristo valmistajan ohjeiden mukaisesti.

Procedure To: Replace the Battery

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Record CMOS settings.
3	Turn OFF the computer.
4	Disconnect the computer's power cord and all external peripheral equipment.
5	Remove the computer cover. .
6	Locate the battery on the motherboard (See Figure 1/ Callout M)
7	Gently pry the battery free from its socket using a small flat bladed screwdriver. Note the orientation of the "+" on the battery  **Figure 12.**
8	Install the new battery in the socket, orienting the "+" as shown in the illustration.
9	Replace the computer cover.
10	Update CMOS records with any changes.

How to Clear Passwords

⟹ NOTE

This procedure assumes that the motherboard is installed in the computer and the configuration jumper block (J4J1) has the jumper set on pins 1-2 for normal mode.

Procedure To: Clear Passwords

Step	Action
1	Observe the safety precautions in Safety Considerations at the beginning of this chapter.
2	Turn OFF the computer.
3	Disconnect the computer's power cord and all external peripheral equipment.
4	Remove the computer cover. .
5	Locate the configuration jumper block (See Figure 11, Configuration Jumper Block).
6	Move the jumper to pins 2-3.
7	Replace the cover and turn ON the computer.
8	Allow the computer to boot up.
9	The computer starts the Setup Program and the Maintenance Menu is displayed.
10	Use the arrow keys to select CLEAR PASSWORDS from the Maintenance Menu.
11	Press <ENTER> key.
12	Setup displays a pop-up screen requesting confirmation of clearing the password.
13	Select YES then Press <ENTER> key.
14	Setup displays the Maintenance Menu once again.
15	Press <F10> to save current values and EXIT Setup.
16	Turn OFF the computer.
17	Remove the computer cover.
18	On the Jumper Block (J4J1) move the jumper back to pins 1-2 to restore normal operation.
19	Replace the computer cover.

3 Using the BIOS Setup Program

This chapter provides an overview of the BIOS Setup Program. This program enables you to change the BIOS settings of your computer.

This chapter covers the following topics:

Topic	Page
Setup Program Modes	54
Setup Program Menus	55
Menu Functionality	56
Menu Function Keys	56
Maintenance Menu	57
Main Menu	57
Advanced Menu	58
Peripheral Configuration Submenu	59
IDE Configuration Submenu	60
Floppy Options Submenu	61
DMI Event Logging Submenu	62
Video Configuration Submenu	62
Security Menu	63
Power Menu	63
Boot Menu	64
Boot Options	65
Hard Drive Submenu	65
Removable Devices Submenu	66
Exit Menu	66

Setup Program Modes

NOTE

The Setup Program is used for viewing and changing the BIOS settings for your computer.

It is recommended that you write down the current Setup settings for reference puproses. Then when you make changes to these settings, update your record accordingly.

To access Setup, press the <F2> key after the Power-On Self Test (POST) memory test begins but before the operating system boot begins.

Modes

The Setup Program has three modes of operation as shown in Table 12.

Table 12. Setup Program Modes

Operational mode	Is used for ...
Normal	Normal system operations.
Configure	Configuring the processor speed. Clearing passwords.
Recovery	Recovering the BIOS data.

Mode Control

The Setup Program's operational mode is controlled by the setting of the configuration jumper block J4J1. The jumper is usually set to Normal mode at the factory.

Table 13 shows the jumper settings for the different Setup modes.

Table 13. Jumper Settings

Mode	Jumper	Description
Normal	1-2	BIOS uses current configuration and passwords for booting.
Configure	2-3	After the POST runs, Setup starts and displays the Maintenance Menu. This menu displays options for setting the processor speed and clearing passwords.
Recovery	None	BIOS recovers data from a recovery diskette. Refer to Section 4 for information on BIOS data recovery during an upgrade.

Setup Program Menus

This diagram illustrates the Setup Program's menu structure.

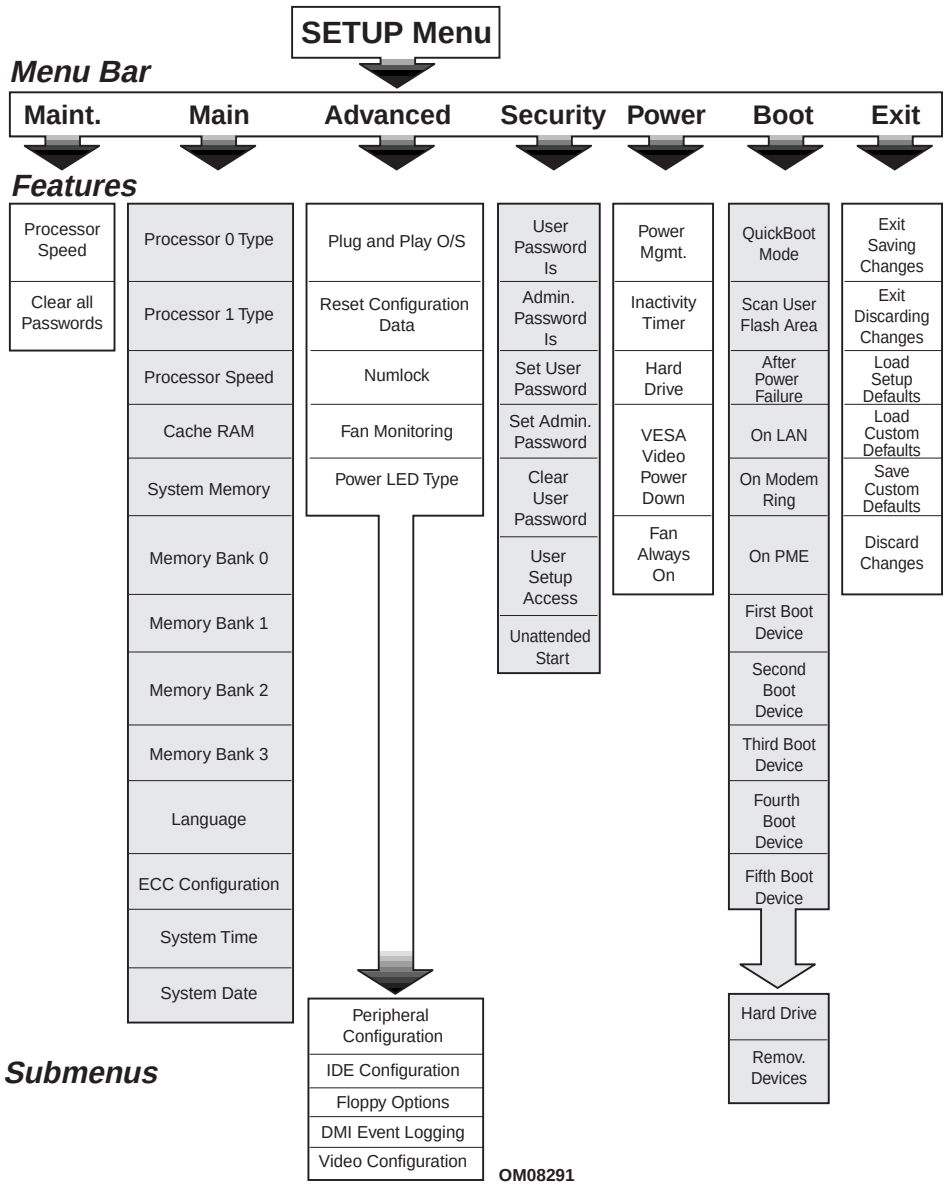


Figure 13. Setup Program Menu Structure

Menu Functionality

Table 14 explains the functionality associated with each Setup Program menu screen.

Table 14. Setup Menu Bar

Setup Menu Screen	Functionality
Maintenance	Specifies the processor speed and clears the Setup passwords. This menu is only available in configure mode.
Main	Allocates resources for hardware components.
Advanced	Specifies advanced features available through the chipset.
Security	Specifies passwords and security features.
Power	Specifies power management features.
Boot	Specifies boot options and power supply controls.
Exit	Saves or discards changes to the Setup program options.

Menu Function Keys

Table 15 shows the function keys available for use with the Setup Program menu screens.

Table 15. Setup Function Keys

Setup Key	Description
<F1> or <Alt-H>	Brings up a help screen for the current item.
<Esc>	Exits the menu.
<←> or <→>	Selects a different menu screen.
<↑> or <↓>	Moves cursor up or down.
<Home> or <End>	Moves cursor to top or bottom of the window.
<PgUp> or <PgDn>	Moves cursor to top or bottom of the window.
<F5> or <->	Selects the previous value for a field.
<F6> or <+> or <Space>	Selects the next value for a field.
<F9>	Load the default configuration values for the current menu.
<F10>	Save the current values and exit Setup.
<Enter>	Executes command or selects the submenu.
<+> or <->	Toggles to next or previous submenu selection.

Maintenance Menu

Use this menu to set the processor speed and clear Setup passwords. Setup only displays this menu in configure mode.

Table 16. Maintenance Menu

Feature	Options	Description
Processor Speed	300 MHz 350 MHz 400 MHz 450 MHz 500 MHz	Specifies the processor speed in megahertz.
Clear All Passwords	No options	Clears the user and administrator passwords.

Main Menu

This menu reports processor and memory information. Use the Main Menu to configure the system date, system time, floppy options, and IDE devices.

Table 17. Main Menu

Feature	Options	Description
Processor 0 Type	No options	Displays processor type.
Processor 1 Type	No options	Displays processor type.
Processor Speed	No options	Displays processor speed.
Cache RAM	No options	Displays size of second-level cache.
System Memory	No options	Displays the total amount of RAM on the motherboard.
Memory Bank 0,1,2,3	No options	Specifies the size and type of DIMMs installed in each respective memory bank.
Language	English (US)	Selects the language used by the BIOS.
ECC Configuration	None	Specifies the ECC memory configuration.
System Time	Hour, minute, and second	Specifies the current time.
System Date	Month, day, and year	Specifies the current date.

Advanced Menu

Use this menu to set advanced features that are available through the chipset.

Table 18. Advanced Menu

Feature	Options	Description
Plug & Play O/S	**No (default)** Yes	Specifies if a Plug and Play operating system is being used. No lets the BIOS configure all devices and steers SCI to INT20 of the IOAPIC. Yes lets the operating system configure Plug and Play devices and steers SCI to INT9 of the IOAPIC. Not required with a Plug and Play operating system.
Reset Configuration Data	**No (default)** Yes	Clears the BIOS configuration data on the next boot.
Numlock	**Auto (default)** On Off	Specifies the power on state of the Numlock feature on the numeric keypad of the keyboard.
Fan Monitoring	Fan 4 J8L1 Fan 3 J8M1and J13A1 Fan 2 J2L1 and J14G1 Fan 1 J2K1 and J3J1	Sets which fan headers are monitored.
Power LED Type	**Single Color (default)** Dual Color	Set this option based on what type of LED is used for power LED on your chassis. A single color LED is typically Green or OFF. A dual color LED can be Green, Yellow or OFF. A single color LED will blink during SUSPEND, whereas a two-color LED will turn Yellow.
Peripheral Configuration submenu	**No options**	Configures peripheral ports and devices. When selected, displays the Peripheral Configuration submenu.
IDE Configuration submenu	**No options**	Reports type of connected IDE device. When selected, displays the Primary IDE Master submenu.
Floppy Options submenu	**No options**	When selected, displays the Floppy Options submenu.
DMI Event Logging submenu	**No options**	Configures DMI Events Logging. When selected, displays the DMI Events Logging submenu.
Video Configuration submenu	**No options**	Configures video features. When selected, displays the Video Configuration submenu.

Peripheral Configuration Submenu

Use this submenu to configure the computer peripherals.

Table 19. Peripheral Configuration Submenu

Feature	Options	Description
Serial port A	Disabled Enabled **Auto (default)**	Configures serial port A. Auto assigns the first free COM port, normally COM1, the address 3F8h, and the interrupt IRQ4. An * (asterisk) displayed next to an address indicates a conflict with another device.
Serial port B	Disabled Enabled **Auto (default)**	Configures serial port B. Auto assigns the first free COM port, normally COM2, the address 2F8h, and the interrupt IRQ3. An * (asterisk) displayed next to an address indicates a conflict with another device. If either serial port address is set, that address will not appear in the list of options for the other serial port.
Mode	**Normal (default)** IrDA ASK-IR	Selects the mode for serial port B.
Parallel port	Disabled Enabled **Auto (default)**	Configures the parallel port. Auto assigns LPT1 the address 378h and the interrupt IRQ7. An * (asterisk) displayed next to an address indicates a conflict with another device.
Mode	Output Only Bi-directional EPP **ECP (default)**	Selects the mode for the parallel port. Output Only operates in AT†-compatible mode. Bi-directional operates in bidirectional PS/2-compatible mode. EPP is Extended Parallel Port mode, a high-speed bidirectional mode. ECP is Enhanced Capabilities Port mode, a high-speed bidirectional mode.
Audio	Disabled **Enabled (default)**	Enables or disables the onboard audio subsystem.
LAN	Disabled **Enabled (default)**	Enables or disables the LAN.
Embedded PXE Support	Disabled **Enabled (default)**	Enables or disables the embedded PXE support.
Legacy USB Support	**Disabled (default)** Enabled	Enables support for legacy universal serial bus.

IDE Configuration Submenus

This submenu is for configuring IDE devices, including:

- Primary IDE master
- Primary IDE slave
- Secondary IDE master
- Secondary IDE slave

Table 20. IDE Configuration Submenus

Feature	Options	Description
IDE Controller	Disabled Primary Secondary **Both (default)**	Configures the IDE Controller. Both specifies that both the Primary and Secondary channels are used.
Hard Disk Pre-Delay	**Disabled (default)** 3 Seconds 6 Seconds 9 Seconds 12 Seconds 15 Seconds 21 Seconds 30 Seconds	Specifies hard disk pre-delay time.
Type	None ATAPI Removable CD-ROM IDE Removable Other ATAPI User **Auto (default)**	Specifies the IDE configuration mode for IDE devices. IDE Removable allows the cylinders, heads, and sectors fields to be changed. Auto automatically fills in the values for the cylinders, heads, and sectors fields.
Cylinders	1 to XXXX	Specifies number of disk cylinders.
Heads	1 to 16	Specifies number of disk heads.
Sectors	1 to 64	Specifies number of disk sectors.
Maximum Capacity	No options	Reports the maximum capacity for the hard disk. Value calculated from number of cylinders, heads, and sectors.
Multi-Sector Transfers	Disabled 2 Sectors 4 Sectors 8 Sectors **16 Sectors (default)**	Specifies number of sectors per block for transfers from the hard drive to memory. Check the hard drive's specifications for optimum setting.

Continued

Table 20. IDE Configuration Submenus (continued)

Feature	Options	Description
LBA Mode Control	Disabled **Enabled (default)**	Enables or disables logical block addressing (LBA) in place of the Cylinders, Heads, and Sectors fields. ⚠ **CAUTION** *Changing the LBA Mode Control after a hard drive has been formatted can corrupt data on the drive*.
Transfer Mode	Standard Fast PIO 1 Fast PIO 2 Fast PIO 3 Fast PIO 4 **FPIO 3 / DMA 1 (default)** Mastering FPIO 4 / DMA 2	Specifies method for transferring data between the hard drive and system memory.
Ultra DMA	**Disabled (default)** Mode 0 Mode 1 Mode 2	Specifies the ultra DMA mode for the hard drive.

Floppy Options Submenu

This submenu is used to configure diskette drives.

Table 21. Floppy Options Submenu

Feature	Options	Description
Floppy Disk Controller	Disabled **Enabled (default)**	Configures the diskette drive controller.
Diskette A:	Disabled 360 KB, 5¼″ 1.2 MB, 5¼″ 720 KB, 3½″ **1.44/1.25 MB, 3½″ (default)** 2.88 MB, 3½″	Specifies the capacity and physical size of diskette drive A.
Diskette B:	**Disabled (default)** 360 KB, 5¼″ 1.2 MB, 5¼″ 720 KB, 3½″ 1.44/1.25 MB, 3½″ 2.88 MB, 3½″	Specifies the capacity and physical size of diskette drive B.
Floppy Write Protect	**Disabled (default)** Enabled	Disables or enables write protect for the diskette drive(s).

DMI Event Logging Submenu

Use this submenu to configure the DMI event logging features.

Table 22. DMI Event Logging Submenu

Feature	Options	Description
Event log capacity	No options	Indicates if there is space available in the event log.
Event log validity	No options	Indicates if the contents of the event log are valid.
View DMI event log	No options	Enables viewing of DMI event log.
Clear all DMI event logs	**No (default)** Yes	Clears the DMI Event Log after rebooting.
Event Logging	Disabled **Enabled (default)**	Enables logging of DMI events.
ECC Event Logging	Disabled **Enabled (default)**	Enables logging of ECC events.
Mark DMI events as read	No options	Marks all DMI events as read.

Video Configuration Submenu

Use this submenu to configure video features.

Table 23. Video Configuration Submenu

Feature	Options	Description
Palette Snooping	**Disabled (default)** Enabled	Controls the ability of a primary PCI graphics controller to share a common palette with an ISA add-in video card.

Security Menu

Use this menu to set passwords and security features.

Table 24. Security Menu

Feature	Options	Description
User Password Is	No options	Reports if there is a user password set.
Administrator Password Is	No options	Reports if there is an administrator password set.
Set User Password	Password can be up to seven alphanumeric characters.	Specifies the user password.
Set Administrative Password	Password can be up to seven alphanumeric characters.	Specifies the administrator password.
Clear User Password	No options	Pressing <Enter> clears the user password.
User Setup Access	None **View Only (default)** Limited Access Full	Enables or disables user access to the Setup program.
Unattended Start	**Disabled (default)** Enabled	Enables the unattended start feature. When enabled, the computer boots, but the keyboard is locked. The user must enter a password to unlock the computer or boot from a diskette.

Power Menu

Use this menu to set power management features.

Table 25. Power Menu

Feature	Options	Description
Power Management	Disabled **Enabled (default)**	Enables or disables the BIOS power management feature.
Inactivity Timer	**Off (default)** 1 Minute 5 Minutes 10 Minutes 20 Minutes 30 Minutes 60 Minutes 120 Minutes	Specifies the amount of time before the computer enters standby mode.
Hard Drive	Disabled **Enabled (default)**	Enables power management for hard disks during standby and suspend modes.
VESA† Video Power Down	Disabled **Enabled (default)**	Enables power management for video during standby and suspend modes.
Fan Always On	**No (default)** Yes	Select YES to force a fan to remain on when the system is in a power-managed state.

Boot Menu

Use this menu to specify the boot features and the boot sequence.

Table 26. Boot Menu

Feature	Options	Description
QuickBoot Mode	Disabled **Enabled (default)**	Enables the computer to boot without running certain POST tests.
Scan User Flash Area	**Disabled (default)** Enabled	Enables the BIOS to scan the flash memory for user binary files that are executed at boot time.
After Power Failure	Stay Off **Last State (default)** Power On	Specifies how the computer responds following a power failure. Stay Off keeps power OFF until the power button is pressed. Last State restores previous power state before a power failure. Power On restores power without restoring previous power state.
On LAN	Stay Off **Power On (default)**	Specifies how the computer responds to a LAN wakeup event when the power is OFF.
On Modem Ring	**Stay Off (default)** Power On	Specifies how the computer responds to an incoming call on an installed modem when the power is off.
On PME	**Stay Off (default)** Power On	Specifies how the computer responds to a PCI power management enable event when the power is OFF.
First Boot Device Second Boot Device Third Boot Device Fourth Boot Device Fifth Boot Device	Removable devices Hard Drive ATAPI CD-ROM Drive Network boot LANDesk Service Agent	Specifies the boot sequence from the available devices. To Specify Boot Sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. 3. The operating system assigns a drive letter to each boot device in the order listed. 4. Changing the order of the devices changes the drive lettering.
Hard Drive submenu	No options	Lists available hard drives. When selected, displays the Hard Drive submenu.
Removable Devices submenu	No options	Lists available removable devices. When selected, displays the Removable Devices submenu.

Boot Options

In the Setup program, the user can choose to boot from a diskette drive, hard drive, CD-ROM, or the network. The default setting is for the diskette drive to be the primary boot device and the hard drive to be the secondary boot device.

Booting from CD-ROM is supported in compliance to the El Torito bootable CD-ROM format specification. Under the Boot menu in the Setup program, CD-ROM is listed as a boot device. Boot devices are defined in priority order.

The network can be selected as a boot device. This selection allows booting from a network add-in card or on-board LAN with a remote boot ROM installed. The LANDesk Service Agent can be used to perform service boots if the network is equipped with a suitable LANDesk Configuration Manager server.

Hard Drive Submenu

Use this submenu to configure the boot sequence for hard drives.

Table 27. Hard Drive Submenu

Options	Description
Installed hard drive Bootable ISA Cards	Specifies the boot sequence for the hard drives attached to the computer. To Specify Boot Sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. 3. The operating system assigns a drive letter to each device in the order listed. 4. Changing the order of the devices changes the drive lettering.

Removable Devices Submenu

Use this submenu to configure the boot sequence for removable devices.

Table 28. Removable Devices Submenu

Options	Description
Legacy Floppy Drives	Specifies the boot sequence for the removable devices attached to the computer. To Specify Boot Sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <+> to move the device up the list or <-> to move the device down the list. 3. The operating system assigns a drive letter to each device in the order listed. 4. Changing the order of the devices changes the drive lettering.

Exit Menu

Use this menu to exit the Setup Program, save changes, load defaults, and save defaults.

Table 29. Exit Menu

Feature	Description
Exit Saving Changes	Exits and saves the changes in CMOS RAM.
Exit Discarding Changes	Exits without saving any changes made in Setup.
Load Setup Defaults	Loads the default values for all the Setup options.
Load Custom Defaults	Loads the custom defaults for Setup options.
Save Custom Defaults	Saves the current values as custom defaults. Normally, the BIOS reads the Setup values from flash memory. If this memory is corrupted, then the BIOS reads the custom defaults. If no custom defaults are set, then the BIOS reads the factory defaults.
Discard Changes	Discards changes without exiting Setup. The option values present when the computer was turned on are used.

4 Using the BIOS Features

The MS440GX motherboard uses an Intel/Phoenix BIOS, which is stored in flash memory and can be upgraded using a disk-based program.

The flash memory also contains the BIOS Setup Program (described in Chapter 3), Power-On Self Test (POST), Advanced Power Management (APM), the PCI auto-configuration utility, and Windows 98-ready Plug and Play code.

This motherboard supports system BIOS shadowing, allowing the BIOS to execute from 64-bit onboard write-protected DRAM.

The BIOS displays a message during POST identifying the type of BIOS and the revision code. The initial production BIOS is identified as 4M4SG0X0.86E.

This chapter covers the following topics:

Topic/Procedure	Page
How to Prepare for the Upgrade	68
Obtaining the BIOS Upgrade File	68
Recording the Current BIOS Settings	68
Creating a Bootable Floppy Disk	69
Creating the BIOS Upgrade Floppy Disk	69
Upgrading the BIOS	70
Recovering the BIOS	71
Changing the BIOS Language	72
Plug and Play: PCI Autoconfiguration	72
ISA Plug and Play	73
ISA Legacy Devices	73
PCI IDE Support	73
Desktop Management Interface (DMI)	74
Advanced Power Management (APM)	74
Advanced Configuration and Power Interface (ACPI)	75
Language Support	76
OEM Logo or Scan Area	76
USB Legacy Support	77
BIOS Security Features	77
Recovering the BIOS Data	78

How to Prepare for the Upgrade

Before attempting to upgrade the BIOS, prepare for the upgrade process as follows:

- Obtain the BIOS upgrade file
- Record the current BIOS settings
- Create a bootable floppy disk
- Create the BIOS upgrade floppy disk

Obtaining the BIOS Upgrade File

Use the BIOS upgrade file to upgrade to a new version of the BIOS.

The BIOS upgrade file is a compressed self-extracting archive that contains all the files you need to upgrade the BIOS. The file contains the following elements:

- New BIOS files
- BIOS recovery files
- Intel Flash Memory Update Utility

You can obtain the BIOS upgrade file from the Intel World Wide Web site:

http://www.intel.com.

NOTE

Please review the instructions distributed with the update utility before attempting a BIOS upgrade.

The Intel Flash Memory Update Utility allows you to:

- *Upgrade the BIOS in flash memory.*
- *Update the language section of the BIOS.*

Recording the Current BIOS Settings

1. Boot the computer and press <F2> when you see the message:

```
Press <F2> Key if you want to run SETUP
```

NOTE

Do not skip step 2. You will need these settings to configure your computer at the end of the upgrade procedure.

2. Write down the current settings in the BIOS Setup program.

Creating a Bootable Floppy Disk

NOTE

If your drive A is an LS-120 diskette drive, then you must use a 1.44-MB floppy diskette as the bootable BIOS upgrade floppy disk. The computer is unable to recover a BIOS from an LS-120 diskette.

Procedure To: Create a Bootable Floppy Disk

Step	Action
1	Use a DOS or Windows 95 system to create the floppy disk.
2	Insert a floppy disk in floppy drive A.
3	or for a formatted floppy disk, type: `sys a:`
4	Press `<Enter>`.

Creating the BIOS Upgrade Floppy Disk

Obtain the BIOS upgrade and then use the procedure in the following table.

Procedure To: Create the BIOS Upgrade Floppy Disk

Step	Action
1	Copy the BIOS upgrade file to a temporary directory on your hard disk.
2	From the C:\ prompt, change to the temporary directory.
3	To extract the file, type the name of the BIOS upgrade file, for example: `10006BI1.EXE`
4	Press `<Enter>`. The extracted file contains the following files: `LICENSE.TXT, BIOINSTR.TXT, BIOS.EXE`
5	Read the `LICENSE.TXT` file, which contains the software license agreement and the `BIOINSTR.TXT` file, which contains the instructions for the BIOS upgrade.
6	Insert a bootable floppy disk into drive A.
7	To extract the `BIOS.EXE` file to the floppy disk, change to the temporary directory that holds the `BIOS.EXE` file and type: `BIOS A:`
8	Press `<Enter>`.
9	The floppy disk now holds the new BIOS files, the Intel Flash Update Utility, and the recovery files.

Upgrading the BIOS

Procedure To: Upgrade the BIOS

Step	Action
1	Boot the computer with the BIOS upgrade floppy disk in drive A.
2	The flash memory update utility screen appears.
3	Select `Update Flash Memory From a File`.
4	Select `Update System BIOS`.
5	Press <Enter>.
6	Use the arrow keys to select the correct `.bio` file.
7	Press <Enter>.
8	When the utility asks for confirmation to flash the new BIOS into memory. Then select `Continue with Programming.`
9	Press <Enter>.
10	When the utility displays the message `upgrade is complete.` Then remove the floppy disk.
11	Press <Enter>.
12	As the computer boots, check the BIOS identifier (version number) to ensure that the upgrade was successful.
13	When you see the message `Press <F2> Key if you want to run SETUP` Then Press <F2> to enter the BIOS Setup Program.
14	For proper operation, load the BIOS Setup Program defaults by pressing <F9>.
15	Press <Enter> to accept the defaults.
16	Set the options in the BIOS Setup Program to the settings you wrote down before the BIOS upgrade.
17	Press <F10> to save the settings.
18	Press <Enter> to accept the settings.
19	Turn OFF the computer and reboot.

Recovering the BIOS

Although unlikely, if an interruption should occur during a BIOS upgrade, the BIOS could be damaged. If a BIOS upgrade interruption does occur, then follow the procedure in the following table to recover the BIOS. This procedure uses recovery mode for the BIOS Setup Program.

NOTE

Because of the small amount of code available in the non-erasable boot block area, there is no video support. You will not see anything on the screen during this procedure. Monitor the procedure by listening to the speaker and looking at the floppy drive LED.

Procedure To: Recover the BIOS

Step	Action
1	Turn OFF the computer.
2	Disconnect the computer's power cord and disconnect all external peripherals.
3	Remove the computer cover and locate the configuration jumper block.
4	Remove the jumper from the BIOS Setup configuration jumper block (J4J1) to set recovery mode for Setup. See page 42 for the location of the BIOS Setup configuration jumper block.
5	Insert the bootable BIOS upgrade floppy disk into floppy drive A.
6	Replace the computer cover, connect the power cord, turn ON the computer, and allow it to boot. The recovery process will take a few minutes.
7	Listen to the speaker. Two beeps and the end of activity in drive A indicate successful BIOS recovery. A series of continuous beeps indicates failed BIOS recovery.
8	If recovery fails, return to Step 1 and repeat process.
9	If recovery is successful, turn off the computer and disconnect its power cord.
10	Remove the computer cover and continue with the following steps.
11	Replace the jumper back on to pins 1-2 on the BIOS Setup configuration jumper block (J4J1) to set normal mode for Setup.
12	Leave the upgrade disk in drive A, replace the computer cover, and connect the computer's power cord.
13	Turn on the computer and continue with the BIOS upgrade procedure.

Changing the BIOS Language

You can use the BIOS upgrade utility to change the language the BIOS uses for messages and the Setup program. Use a bootable floppy disk containing the Intel Flash Memory Update Utility and language files (see “Upgrading the BIOS” on Page 70).

Procedure To: Change the BIOS Language

Step	Action
1	Boot the computer with the bootable floppy disk in drive A.
2	The BIOS upgrade utility screen appears.
3	Select `Update Flash Memory From a File`.
4	Select `Update Language Set`.
5	Press `<Enter>`.
6	Select drive A and use the arrow keys to select the correct `.lng` file.
7	Press `<Enter>`.
8	When the utility asks for confirmation that you want to flash the new language into memory, select `Continue with Programming`.
9	Press `<Enter>`.
10	When the utility displays the message `upgrade is complete`, remove the floppy disk.
11	Press `<Enter>`.
12	The computer will reboot and the changes will take effect.

Plug and Play: PCI Autoconfiguration

The BIOS can be set to automatically configure PCI devices and Plug and Play devices. PCI devices may be onboard or add-in cards. Plug and Play devices are add-in cards built to meet the Plug and Play specification.

Autoconfiguration lets a user insert or remove PCI or Plug and Play cards without having to configure the system. When a user turns on the system after adding a PCI or Plug and Play card, the BIOS can automatically configure interrupts, the I/O space, and other system resources. Any interrupts set to Available in Setup are considered to be available for use by the add-in card.

PCI interrupts are distributed to available ISA interrupts that have not been assigned to an ISA card or to system resources. The assignment of PCI interrupts to ISA IRQs is dependent upon a number of factors including type and number of add-in cards, slot selection, and operating system.

Any change to the hardware or system software configuration can cause a change to the interrupt configuration of existing devices. PCI devices can share an interrupt, but an ISA device cannot share an interrupt allocated to PCI or to another ISA device. Autoconfiguration information is stored in the extended system configuration data (ESCD) format.

For information about the versions of PCI and Plug and Play supported by this BIOS, see Plug and Play Specification Version 1.0a, May 5, 1994, Compaq Computer Corp., Phoenix Technologies Ltd., Intel Corporation.

ISA Plug and Play

If Plug and Play operating system is selected in Setup, then the BIOS autoconfigures only ISA Plug and Play and PCI cards that are required for booting (IPL devices). If Plug & Play OS is not selected in Setup, then the BIOS autoconfigures all Plug and Play ISA and PCI cards.

NOTE

If Plug & Play OS is selected in Setup, then PCI or PnP add-in cards that are not required for booting will not be available unless they are initialized and assigned resources by the operating system or other program.

ISA Legacy Devices

ISA legacy devices are not autoconfigurable, therefore the resources for them must be reserved in the Setup program or with an ISA configuration utility.

PCI IDE Support

If Auto is selected as a primary or secondary IDE device in Setup, then the BIOS automatically sets up the two local-bus IDE connectors with independent I/O channel support. The IDE interface supports PIO Mode 3, PIO Mode 4, and Ultra DMA hard drives and recognizes any ATAPI devices, including CD-ROM drives, tape drives, and LS-120 diskette drives.

The BIOS determines the capabilities of each drive and configures them so as to optimize capacity and performance. To take advantage of the high-capacity storage devices, hard drives are automatically configured for logical block addressing (LBA) and to PIO Mode 3, PIO Mode 4, or Ultra DMA depending on the capability of the drive.

To override the autoconfiguration options, use the specific IDE device options in Setup. The ATAPI specification recommends that ATAPI devices be configured as shown in Table 32.

Table 30. Recommendations for Configuring an ATAPI Device

	Primary Cable		Secondary Cable	
Configuration	Drive 0	Drive 1	Drive 0	Drive 1
Normal, no ATAPI	ATA			
Disk and CD-ROM for enhanced IDE systems	ATA		ATAPI	
Legacy IDE system with only one cable	ATA	ATAPI		
Enhanced IDE with CD-ROM and a tape or two CD-ROMs	ATA		ATAPI	ATAPI

Desktop Management Interface (DMI)

Desktop Management Interface (DMI) is an interface for managing computers in an enterprise environment. The main component of DMI is the management information format (MIF) database, which contains information about the computing system and its components such as system types, capabilities, operational status, and installation dates for system components.

The MIF database defines the data and provides the method for accessing this information.

The BIOS stores and reports the following DMI information:

- BIOS data, such as the BIOS revision level
- Fixed-system data, such as peripherals, serial numbers, and asset tags
- Resource data, such as memory size, cache size, and processor speed
- Dynamic data, such as event detection and error logging

OEMs can use a utility that programs flash memory so the BIOS can report on system and chassis information. This utility is available through Intel sales offices.

DMI does not work directly under non-Plug and Play operating systems (e.g., Windows NT 4.0). However, the BIOS supports a DMI table interface for such operating systems. Using this support, a DMI service-level application running on a non-Plug and Play OS can access the DMI BIOS information.

Advanced Power Management (APM)

The BIOS supports APM and standby mode. The energy saving standby mode can be initiated in the following ways:

- Time-out period specified in Setup
- From the operating system, such as the Suspend menu item in Windows 98

In standby mode, the motherboard reduces power consumption by using SMM capabilities, spinning down hard drives, and reducing power to or turning off VESA DPMS-compliant monitors. Power-management mode can be enabled or disabled in Setup.

While in standby mode, the system retains the ability to respond to external interrupts and service requests, such as incoming faxes or network messages. Any keyboard or mouse activity brings the system out of standby mode and immediately restores power to the monitor.

The BIOS enables APM by default; but the operating system must support an APM driver for the power-management features to work. Windows 98 supports the power management features upon detecting that APM is enabled in the BIOS.

Advanced Configuration and Power Interface (ACPI)

ACPI gives the operating system direct control over the power management and Plug and Play functions of a computer. ACPI requires an ACPI-aware operating system. ACPI features include:

- Plug and Play (including bus and device enumeration) and APM functionality normally contained in the BIOS
- Power management control of individual devices, add-in boards (some add-in boards may require an ACPI-aware driver), video displays, and hard disk drives
- A Soft-off feature that enables the operating system to power off the computer
- Support for multiple wake up events (see Table 32)
- Support for a front panel power and sleep mode switch. Table 31 describes the system states based on how long the power switch is pressed, depending on how ACPI is configured with an ACPI-aware operating system

Table 31. Effects of Pressing the Power Switch

If the system is in this state…	…and the power switch is pressed for	…the system enters this state
Off	Less than four seconds	Power on
On	Less than four seconds	Soft off/Suspend
On	More than four seconds	Fail safe power off
Sleep	Less than four seconds	Wake up

System States and Power States

Under ACPI, the operating system directs all system and device power state transitions. The operating system puts devices in and out of low-power states based on user preferences and knowledge of how devices are being used by applications. Devices that are not being used can be turned off. The operating system uses information from applications and user settings to put the system as a whole into a low-power state.

Wake Up Devices and Events

The table below describes which devices or specific events can wake the computer from specific states. Sleeping states S4BIOS and S5 are the same for the wake up events.

Table 32. Wake Up Devices and Events

These devices/events can wake up the computer…	…from this state
Power switch	S1, S4BIOS, S5
RTC alarm	S1, S4BIOS, S5
LAN	S1, S4BIOS, S5
Modem	S1, S4BIOS, S5
IR command	S1
USB	S1
PS/2 keyboard	S1
PS/2 mouse	S1
Sleep button	S1

Plug and Play

In addition to power management, ACPI provides controls and information so that the operating system can facilitate Plug and Play device enumeration and configuration. ACPI is used only to enumerate and configure motherboard devices that do not have other hardware standards for enumeration and configuration. PCI devices on the motherboard, for example, are not enumerated by ACPI.

BIOS Support

The BIOS supports both APM and ACPI. If the board is used with an ACPI-aware operating, the BIOS provides ACPI support. Otherwise, it defaults to APM support.

Language Support

Five languages are available: American English, German, Italian, French, and Spanish. The default language is American English unless another language is programmed into the BIOS using the flash memory update utility.

The BIOS includes extensions to support the Kanji character set and other non-ASCII character sets. Translations of other languages may become available at a later date.

OEM Logo or Scan Area

A 4 KB flash-memory user area at memory location FFFF8000h-FFFF8FFFh is for displaying a custom OEM logo during POST. A utility is available from Intel to assist with installing a logo into the flash memory. Contact Intel customer support for further information.

USB Legacy Support

USB legacy support enables USB keyboards and mice to be used even when no operating system USB drivers are in place. By default, USB legacy support is disabled and is only intended to be used in accessing BIOS Setup and installing an operating system that supports USB.

This sequence describes how USB legacy support operates in the default (disabled) mode.

1. When you power up the computer, USB legacy support is disabled.
2. POST begins.
3. USB legacy support is temporarily enabled by the BIOS. This allows you to use a USB keyboard to enter the Setup program or the maintenance mode.
4. POST completes and disables USB legacy support (unless it was set to Enabled while in Setup).
5. The operating system loads. While the operating system is loading, USB keyboards and mice are not recognized. After the operating system loads the USB drivers, the USB devices are recognized.

To install an operating system that supports USB, enable USB Legacy support in BIOS Setup and follow the operating system's installation instructions. Once the operating system is installed and the USB drivers configured, USB legacy support is no longer used. USB Legacy Support can be left enabled in BIOS Setup if needed.

NOTES

If USB legacy support is enabled, then do not mix USB and PS/2 keyboards and mice. For example, do not use a PS/2 keyboard with a USB mouse, or a USB keyboard and a PS/2 mouse.

Do not use USB devices with an operating system that does not support USB. USB legacy is not intended to support the use of USB devices in a non USB operating system.

USB legacy support is for keyboards and mice only. Hubs and other USB devices are not supported.

BIOS Security Features

The BIOS includes security features that restrict access to the BIOS Setup program and who can boot the computer. An administrator password and a user password can be set for the Setup program and for booting the computer using options on the Security Menu (see Figure 13) with the following restrictions:

Password Modes

- If in Administrator Mode, then the administrator password gives unrestricted access to view and change all Setup options in the Setup Program.
- If in User Mode, then the user password gives restricted access to view and change Setup options in the Setup Program.

Password Sets

- If only the administrator password is set, then press the <ENTER> key at the password prompt of the Setup Program to allow the user restricted access to Setup.
- If both administrator and user passwords are set then users can enter either password to access Setup and privileges afforded are dependent upon which password is entered.
- When the user password is set, then who can boot the computer is restricted and the password prompt will be displayed before the computer is booted.
- If only the administrator password is set then the computer boots without asking for a password.
- If both passwords are set then enter either password to boot the computer.

Table 33 shows the effects of setting the administrator and user passwords. This table is for reference only and is not displayed on the screen.

Table 33. Administrator and User Password Functions

Password Set	Administrator Mode	User Mode	Setup Options	Password to Enter Setup	Password During Boot
Neither	Can change all options *	Can change all options *	None	None	None
Administrator only	Can change all options	Can change a limited number of options	Administrator Password	Administrator	None
User only	N/A	Can change all options	Enter Password Clear User Password	User	User
Administrator and user set	Can change all options	Can change a limited number of options	Administrator Password Enter Password	Administrator or user	Administrator or user

* If no password is set, then any user can change all Setup options.

Recovering BIOS Data

Some types of failure can destroy the BIOS. For example, the data can be lost if a power outage occurs while the BIOS is being updated in flash memory. The BIOS can be recovered from a diskette using the BIOS recovery mode

To create a BIOS recovery diskette, a bootable diskette must be created and the recovery files copied to it. The recovery files are available from Intel. Contact Intel customer support for further information.

⟹ NOTE

If the computer is configured to boot from an LS-120 diskette), then the BIOS recovery diskette must be a standard 1.44 MB diskette, not a 120 MB diskette

5 Technical Reference

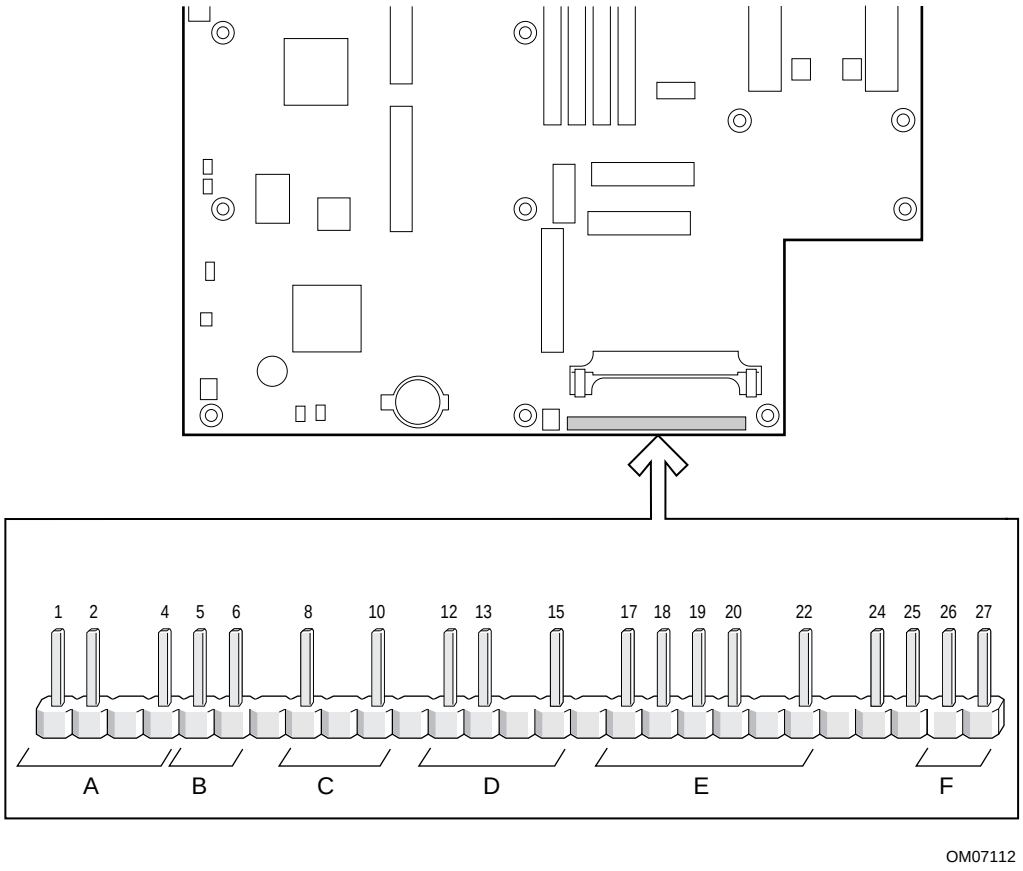
This chapter describes the location, pinouts, and signals associated with the various types of connectors used in the MS440GX motherboard.

This chapter covers the following topics:

Topic/Procedure	Page
Front Panel Connectors	80
Front Panel I/O Connectors	81
Speaker	81
Reset Switch	81
Power/Sleep LED	82
Hard Drive Activity LED	82
Infrared Port	82
Power Switch	82
Front Panel Pin Connector Mapping	83
Back Panel Connectors	84
Keyboard and Mouse Interface	85
Universal Serial Bus (USB)	85
Parallel Port	86
Serial Ports	86
I/O Shield	88
Midboard Connectors	89
Add-in Card Connectors	90
Audio Connectors	91
CD-ROM Audio	92
Telephony	92
Fan Connectors	93
Thermal Considerations	94
Power Connectors	96
Peripheral Interface Connectors	99
Security and Hardware Management Connectors	100
Chassis Intrusion connectors	102
Wake on LAN Technology Connector	102
Wake on Modem	102
Memory Map	103
DMA Channels	103
I/O Map	104
PCI Configuration Space Map	106
LAN Subsystem Software	107
Interrupts	107
PCI Interrupt Routing Map	108
Interrupt Routing Example	109

Front Panel Connectors (L)

The illustration below shows the location of the front panel connectors. Table 34 indicates the functional purpose of each connector identified in the illustration.



A	Speaker	D	Hard disk drive activity LED
B	Reset switch	E	Infrared port
C	Power/sleep LED	F	Power switch

Figure 14. Front Panel Connectors

Table 34. Front Panel I/O Connectors

Call-out	Connector/Function	Pin	Signal Name
A	SPEAKER/ Provides error beep code information during the POST and is not connected to audio subsystem.	1 2 3 4	BUZZER_B1 BUZZER_A2 Key +5V
B	RESET SWITCH/ Resets the motherboard and initiates running the POST.	5 6	FP_RESET# Ground
	NONE	7	Key
C	POWER/SLEEP LED/ Displays indicating if computer is ON or in sleep mode.	8 9 10	GREEN/YELLOW_INV Key YEL_BLNK#
	NONE	11	Key
D	HARD DISK DRIVE ACTIVITY LED/ Visually indicate if data is being read from or written to an IDE or SCSI hard drive.	12 13 14 15	+5V DASDACTIVE# Key +5V
	NONE	16	Key
E	INFRARED PORT/ Can be configured to support an IrDA module enabling data files to be transferred to/from various portable devices.	17 18 19 20 21 22	IRLS1 IRTX Ground IRRX Key +5V
	NONE	23 24 25	Key +5V No Connect (N.C.)
F	POWER ON SWITCH/ Enables system to be powered ON or OFF.	26 27	Ground SWITCH

Speaker

Connect pins 1 and 2 to use the built-in speaker. Leave the jumper off pins 1 and 2 and connect the external speaker to J12A1 to use the external speaker. See page 91 for the location of the external speaker connector.

Reset Switch

Pins 5 and 6 can be connected to a momentary SPST type switch that is normally open.

When the switch is closed, then the motherboard resets and runs the POST.

Power/Sleep LED

These pins can be connected to a multicolor LED that lights when the computer is powered on or in sleep mode. The possible states for this LED are:

If state = OFF, then Power is OFF.

If state = GREEN, then Power is ON.

If state = YELLOW, then in Sleep Mode.

Hard Drive Activity LED

These pins can be connected to an LED to provide a visual indicator that data is being read from or written to an IDE or SCSI hard drive, as well as add-in cards that provide an activity signal. For the LED to function properly, the IDE drive must be connected to the onboard IDE controller. This LED will also show activity for devices connected the the hard drive LED header.

Infrared Port

Serial Port 2 can be configured to support an IrDA module connected to the front panel infrared connector. After the IrDA interface is configured, files can be transferred to or from portable devices such as laptop computers, PDAs, and printers using application software.

Power Switch

Pins 26 and 27 can be connected to a front panel power switch. Because of debounce circuitry on the motherboard, the switch must pull the SW_ON# pin to ground for at least 50 ms to signal the power supply to switch on or off. At least two seconds must pass before the power supply will recognize another on/off signal.

NOTE

When BIOS is active, the power switch is recognized immediately. When BIOS is not active (POST, system lock-up) then the power switch is only recognized if held in for four seconds.

CAUTION

If you need to turn off the computer during POST, then hold the power switch in for four seconds; otherwise the computer will not switch off.

Front Panel Pin Connector Mapping

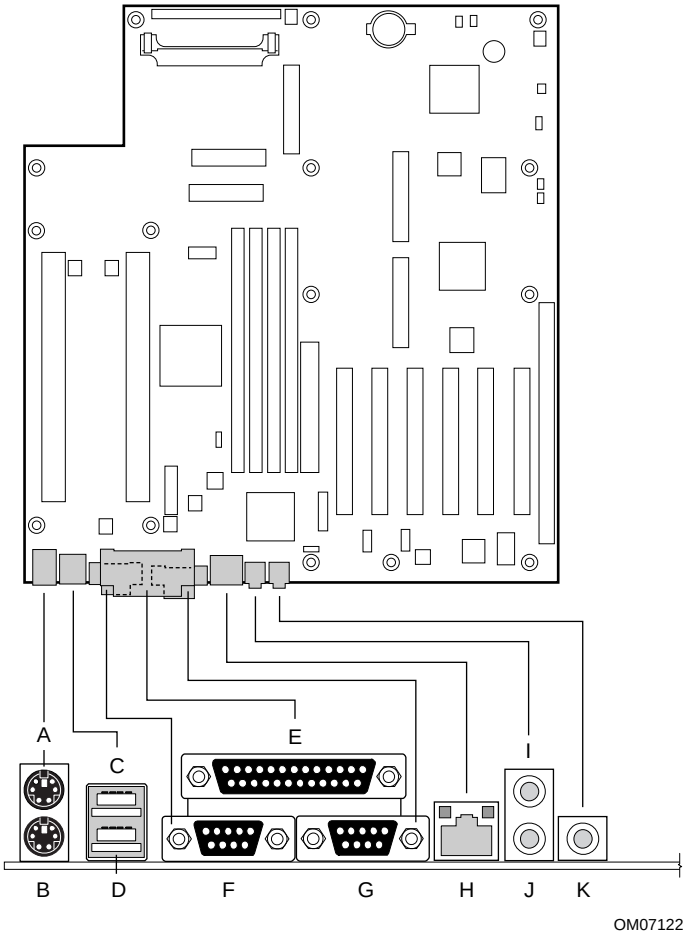
This table describes the operational effect(s) of connecting various devices such as switches and LED lights to the Front Panel pin connectors.

Table 35. Pin Connector Functionality

If pin numbers	are connected to a	Then the operational effect is ....
5,6	Momentary SPST type switch that is normally OPEN.	To reset the motherboard and run the POST when the switch is closed.
8,9,10,11	Multicolor LED that lights when the computer is ON. OR in Sleep Mode. If using a single color LED, it will blink during suspend state.	To visually display one of three states: OFF = Power OFF Green = Power ON Yellow = Sleep
12,13,14,15	LED There are two SCSI LED headers (J10E1 and J10A1) on the board. If you connect a SCSI card's LED cable to either of them and connect the Hard Drive Activity LED on the front panel, then the LED will work either when the IDE hard drive **or** the SCSI drive is operating. When using a SCSI controller card with an activity signal, connect a cable from the card's drive activity header to header J10E1 or J10A1.	To provide a visual indication of data being read from or written to an IDE or SCSI hard drive. AND show activity for devices connected to the hard drive LED header. **NOTE** *IDE drive must be connected to the onboard IDE controller.*
17,18,19,20,21,22	IrDA module	TO enable transfer of files to or from portable devices such as laptop computers, PDAs, and printers using applications software.
26,27	Front Panel power switch that pulls the SW_ON# pin to ground for at least 50 ms	TO turn the computer's power supply ON or OFF. **NOTE** *At least 2 seconds must pass before the power supply will recognize another ON/OFF signal.* **CAUTION** IF you need to turn OFF the computer during POST THEN hold the power switch IN for 4 seconds ELSE the computer will not switch OFF.

Back Panel Connectors (E)

The figure below shows location of the back panel connectors.



A	PS/2 Keyboard or Mouse	G	Serial Port B
B	PS/2 Keyboard or Mouse	H	LAN
C	USB Port 1	I	Audio Line Input
D	USB Port 0	J	Audio Line Output
E	Parallel Port	K	Microphone Input
F	Serial Port A		

Figure 15. Back Panel Connectors

Keyboard and Mouse Interface

PS/2 keyboard and mouse connectors are located on the back panel (see Figure 15/Callouts A and B). The 5V lines to these connectors are protected with a PolySwitch† circuit that, like a self-healing fuse, reestablishes the connection after an over-current condition is removed.

NOTE

The mouse and keyboard can be plugged into either of the PS/2 connectors. Power to the computer should be turned off before a keyboard or mouse is connected or disconnected.

The keyboard controller contains the AMI Megakey keyboard and mouse controller code, provides the keyboard and mouse control functions, and supports password protection for power on/reset. A power on/reset password can be specified in Setup.

The keyboard controller also supports the hot-key sequence <Ctrl><Alt><Del> for a software reset. This key sequence resets the computer's software by jumping to the beginning of the BIOS code and running the Power-On Self Test (POST).

Table 36. PS/2 Keyboard/Mouse Connectors

Pin	Signal Name
1	Data
2	No connect
3	Ground
4	+5 V (fused)
5	Clock
6	No connect

Universal Serial Bus (USB)

The motherboard has two USB ports. One USB peripheral can be connected to each port. For more than two USB devices, an external hub can be connected to either port. The motherboard fully supports the universal host controller interface (UHCI) and uses UHCI-compatible software drivers.

NOTE

Computer systems that have an unshielded cable attached to a USB port may not meet FCC Class B requirements, even if no device or a low-speed USB device is attached to the cable. Use shielded cable that meets the requirements for high-speed devices.

Parallel Port

The connector for the multimode bidirectional parallel port is a 25-pin D-Sub connector located on the back panel (see Figure 15/Callout E). In the Setup program, the parallel port can be configured for the following:

- Compatible (standard mode)
- Bidirectional (PS/2 compatible)
- Extended Parallel Port (EPP)
- Enhanced Capabilities Port (ECP)

Refer to the MS440GX Motherboard Technical Product Specification for connector pinout information.

Serial Ports

The two 9-pin D-Sub serial port connectors on the back panel are compatible with 16450 and 16550A UARTs.

Refer to the MS440GX Motherboard Technical Product Specification for connector pinout information.

Table 37 shows the pinouts for the LAN Connector.

Table 37. LAN Connector

Pin	Signal Name
1	TX+
2	TX-
3	RX+
4	No connect
5	No connect
6	RX-
7	No connect
8	No connect

Table 38. Audio Line In Connector

Pin	Signal Name
Sleeve	Ground
Tip	Audio Left In
Ring	Audio Right In

Table 39. Audio Line Out Connector

Pin	Signal Name
Sleeve	Ground
Tip	Audio Left Out
Ring	Audio Right Out

Table 40. Audio Mic In Connector

Pin	Signal Name
Sleeve	Ground
Tip	Mono In
Ring	Electret Bias Voltage

I/O Shield

Systems based on the MS440GX motherboard need the back panel I/O shield to pass EMI compliance verification. The back panel I/O shield must meet specific dimension and material requirements.

Figure 16 shows the critical dimensions of a chassis-independent I/O shield.

Additional design considerations for I/O shields relative to chassis requirements are described in the ATX form factor specification.

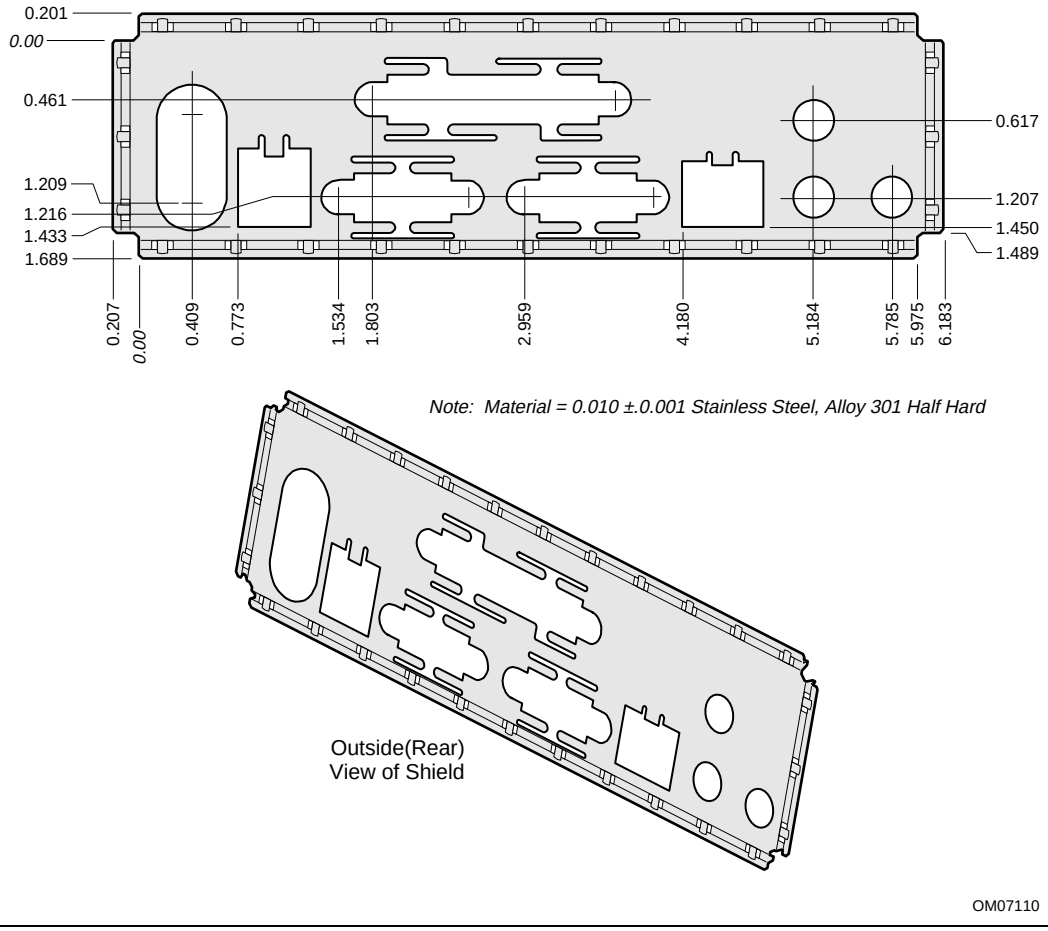


Figure 16. Back Panel I/O Shield Dimensions (ATX Chassis-Independent)

Midboard Connectors

This section addresses the location and functionality associated with the Midboard family of motherboard connectors. The Midboard connectors are organized into the following functional groups.

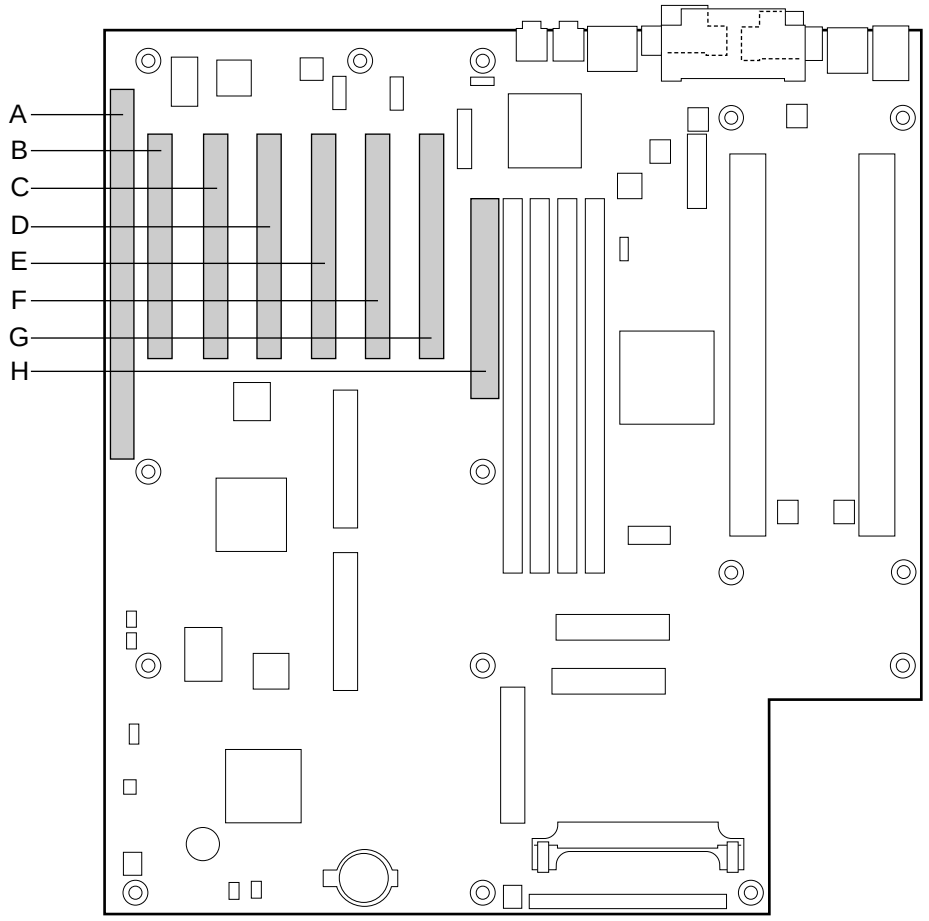
Table 41. Connector Groups

Connector Family	Functional Group(s)	See Figure/Table No.
Add-in Card Connectors	ISA PCI A.G.P.	See MS440GX Technical Product Specification (Order No. 710790-001)
Audio	ATAPI-style Telephony ATAPI CD Audio External Speaker MIDI/Joystick	18/42 18/43 18/44 18/45
Fans	Processor heatsink fans (4) Front chassis fans (2) Rear chassis fans (1)	See MS440GX Technical Product Specification (Order No. 710790-001)
Power	1 x 6 Primary and Secondary VRM	21/48 21/49 21/50
Peripheral Interfaces	Diskette SCSI LED IDE	See MS440GX Technical Product Specification (Order No. 710790-001)
Security and Hardware Management	Front and Rear Intrude Wake on LAN Wake on Modem	23/52 23/53 23/54

Add-in Card Connectors

When the motherboard is installed in a chassis, there are a maximum of seven slots available for installing add-in cards. The table immediately below Figure 17 identifies the seven slots by their callout locations. All of the PCI bus connectors are bus master capable.

Figure 17 shows the location of the add-in card connectors.

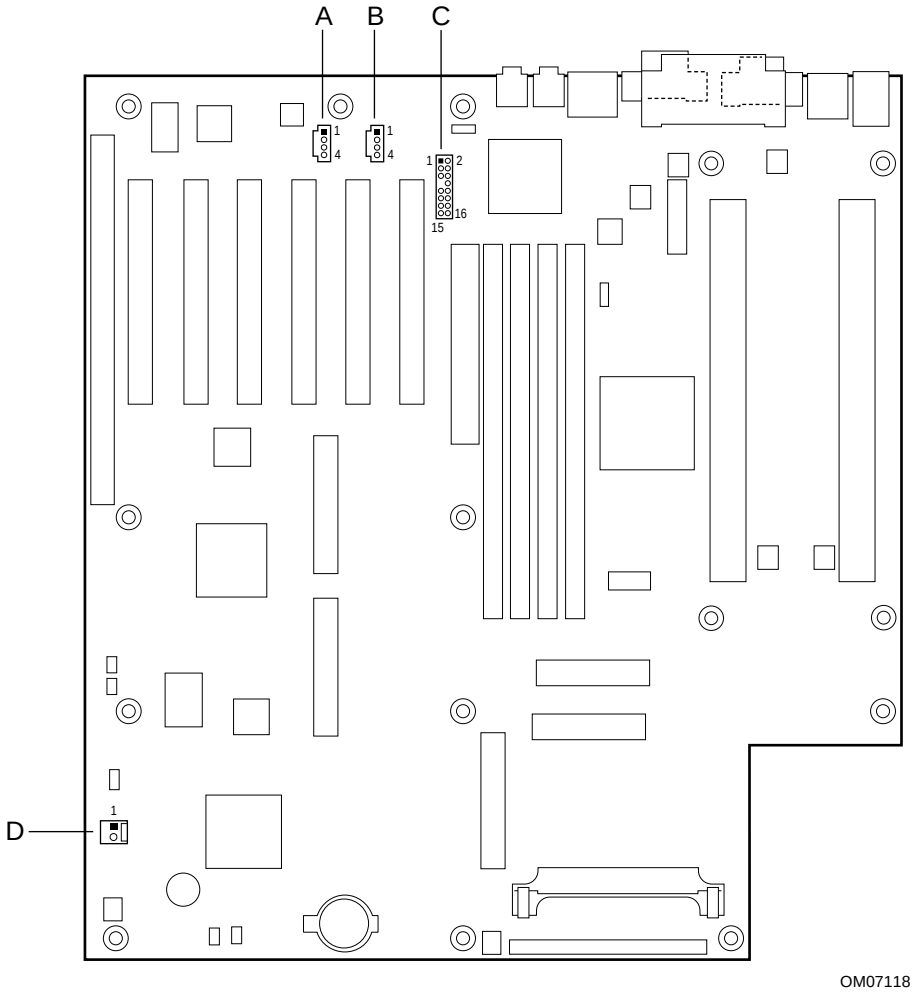


A	ISA slot (shared with PCI bus connector 6)	E	PCI bus connector 3
B	PCI bus connector 6 (shared with ISA bus connector	F	PCI bus connector 2
C	PCI bus connector 5	G	PCI bus connector 1
D	PCI bus connector 4	H	A.G.P. connector

Figure 17. Add-in Card Connectors

Audio Connectors

Figure 18 shows the locations of the audio connectors. Tables 42 through 45 list the pinouts of the audio connectors.



A ATAPI CD-ROM
B ATAPI-style telephony
C MIDI/Joystick
D External speaker

Figure 18. Audio Connectors

The audio connectors include the following:

- Back panel connectors: Line In, Line Out, Mic In
- CD-ROM audio (ATAPI)
- Telephony (ATAPI-style)

CD-ROM Audio

A 1 x 4-pin ATAPI-style connector is available for connecting an internal CD-ROM drive to the audio mixer.

Telephony

A 1 x 4-pin ATAPI-style connector is available for connecting the monaural audio signals of an internal telephony device, such as a modem, to the audio subsystem. A monaural audio-in and audio-out signal interface is necessary for telephony applications such as speakerphones, modems, and answering machines.

Table 42. ATAPI-Style Telephony Connector(J1E1)

Pin	Signal Name
1	MONO_IN (from external device)
2	Ground
3	Ground
4	TEL_MICIN

Table 43. ATAPI CD Audio Connector (J2E1)

Pin	Signal Name
1	Left CD In
2	Ground
3	Ground
4	Right CD In

Table 44. External Speaker Connector (J12A1)

Pin	Signal Name
1	+5V
2	BUZZER_A

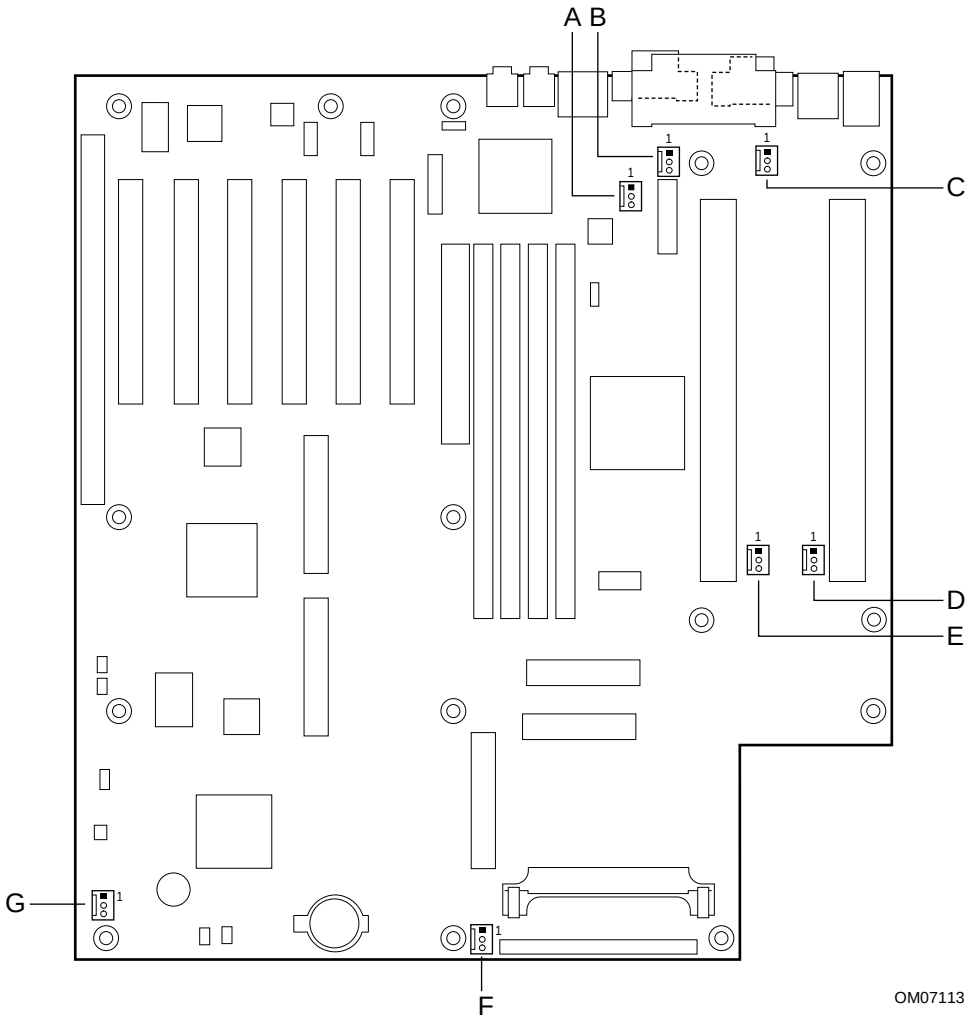
Table 45. MIDI/Joystick Connector (J2E2)

Pin	Signal Name	Pin	Signal Name
1	+5 V (fused)	9	Ground
2	+5 V (fused)	10	JBCY
3	JAB1	11	JACY
4	JBB1	12	JBB2
5	JACX	13	JAB2
6	JBCX	14	MIDI-IN
7	No connect	15	+5 V (fused)
8	MIDI-OUT	16	MIDI-PRESENT GP#

Fan Connectors

There are seven fan connectors on the motherboard. Four connectors are used for processor heatsink fans and three are for chassis fans.

Figure 19 shows the location of the fan connectors. Table 46 lists the pinouts of the fan connectors. The table immediately below Figure 19 indicates the maximum current ratings for the fan connectors.



	Component	Max. Current Rating		Component	Max. Current Rating
A	Rear chassis fan	600 mA	E	Processor heatsink fan	150 mA
B	Processor heatsink fan	150 mA	F	Front chassis fan 1	500 mA
C	Processor heatsink fan	150 mA	G	Front chassis fan 2	300 mA
D	Processor heatsink fan	150 mA			

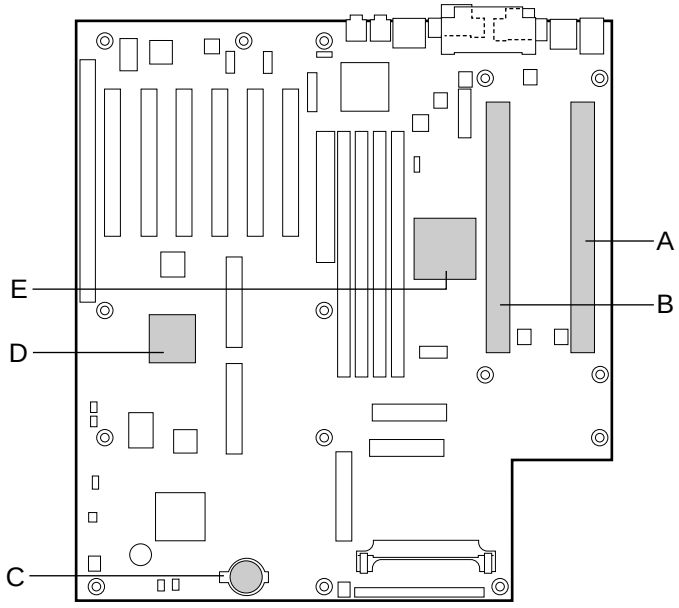
Figure 19. Fan Connectors

Table 46. Fan Connectors

Pin	Signal Name
1	TACH_OUT
2	+12 V
3	FAN_ENABLE

Thermal Considerations

Figure 20 shows the locations of the thermally-sensitive components. Table 47 lists the maximum component case temperatures for motherboard components that could be sensitive to thermal changes. Case temperatures could be affected by the operating temperature, current load, or operating frequency. Maximum case temperatures are important when considering proper airflow to cool the motherboard.



A	Slot 2 (Application Processor)	D	82371EB PIIX4E
B	Slot 2 (Boot Processor)	E	82443GX PAC
C	Battery Case		

Figure 20. Thermally Sensitive Components

⚠ CAUTION

An ambient temperature that exceeds the board's maximum operating temperature by 5 °C to 10 °C might cause components to exceed their maximum case temperature. For information about the maximum operating temperature, see the environmental specifications in Appendix C. When determining system compliance, consideration should be given for maximum rated ambient temperatures.

⚠ CAUTION

The motherboard printed wiring substrate is rated for 105 °C. Care should be taken to ensure the maximum temperature of any component does not exceed the aboard substrate rating. This limit should include a correction value for the maximum ambient operation temperature.

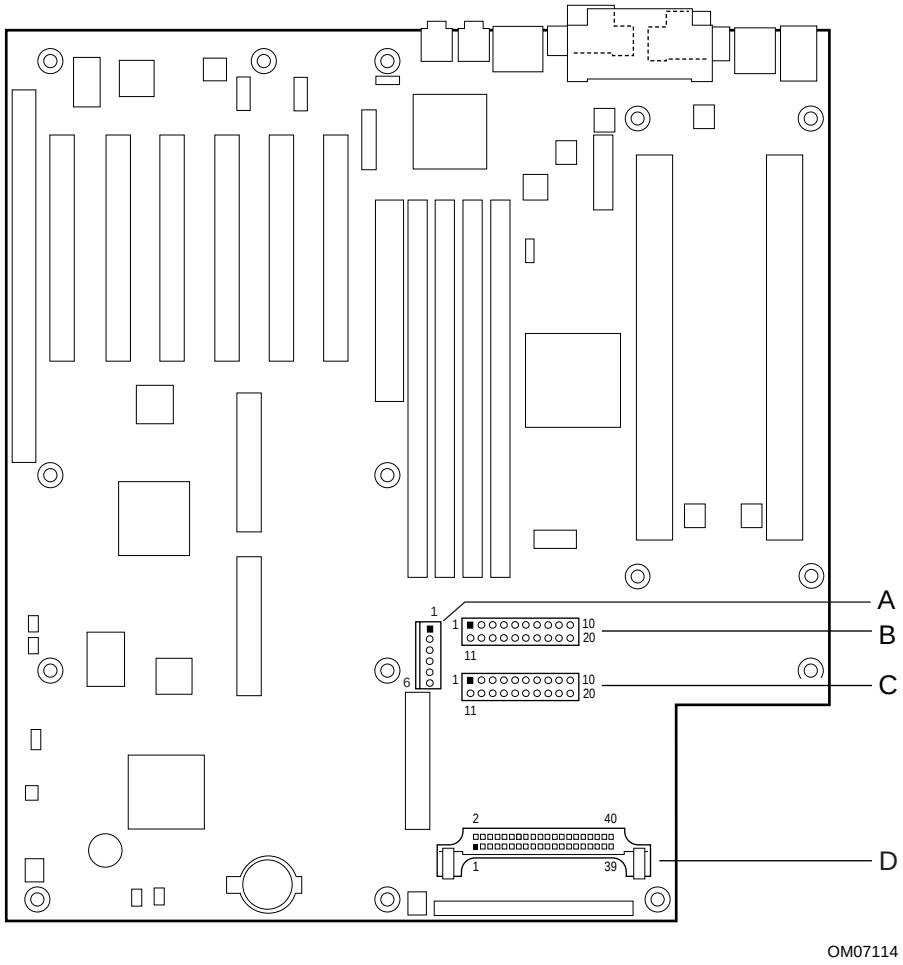
Table 47. Thermal Considerations for Components

Component	Maximum Case Temperature	Motherboard Location(s) (Fig. 1)
Pentium II Xeon processor	75 °C (thermal plate)	F and G
Intel 82443GX (PAC)	105 °C (thermal plate)	H
Intel 82371EB (PIIX4E)	85 °C (thermal plate)	Q
Lithium Battery	70 °C (case)	M
PWB Substrate	105 °C	

Power Connectors

There are three power supply connectors and one connector for a VRM. Figure 21 shows the power connectors. Tables 48 through 50 list the pinouts of the power connectors.

The primary and secondary power supply connectors are identical; either may be used with the 6-pin power connector for system configurations requiring less than 300 W. If the system power requirements exceed 300 W, a power supply with two 20-pin connectors and a 6-pin connector can be used, or dual power supplies can be used. VRMs used with this board must be compatible with the *VRM 8.3 DC-DC Converter Design Guidelines* document.



A	1x6 Power connector	C	Primary power supply connector
B	Secondary power supply connector	D	VRM connector

Figure 21. Power Connectors

When the motherboard is used with an ATX-compliant power supply that supports remote power ON/OFF, then the board can turn OFF system power through software control.

Table 48. 1x6 Power Connector

Pin	Signal Name
1	Ground
2	Ground
3	Ground
4	+3.3 V
5	+3.3 V
6	+5 V (Keyed)

Table 49. Primary and Secondary Power Supply Connectors (J10H1)

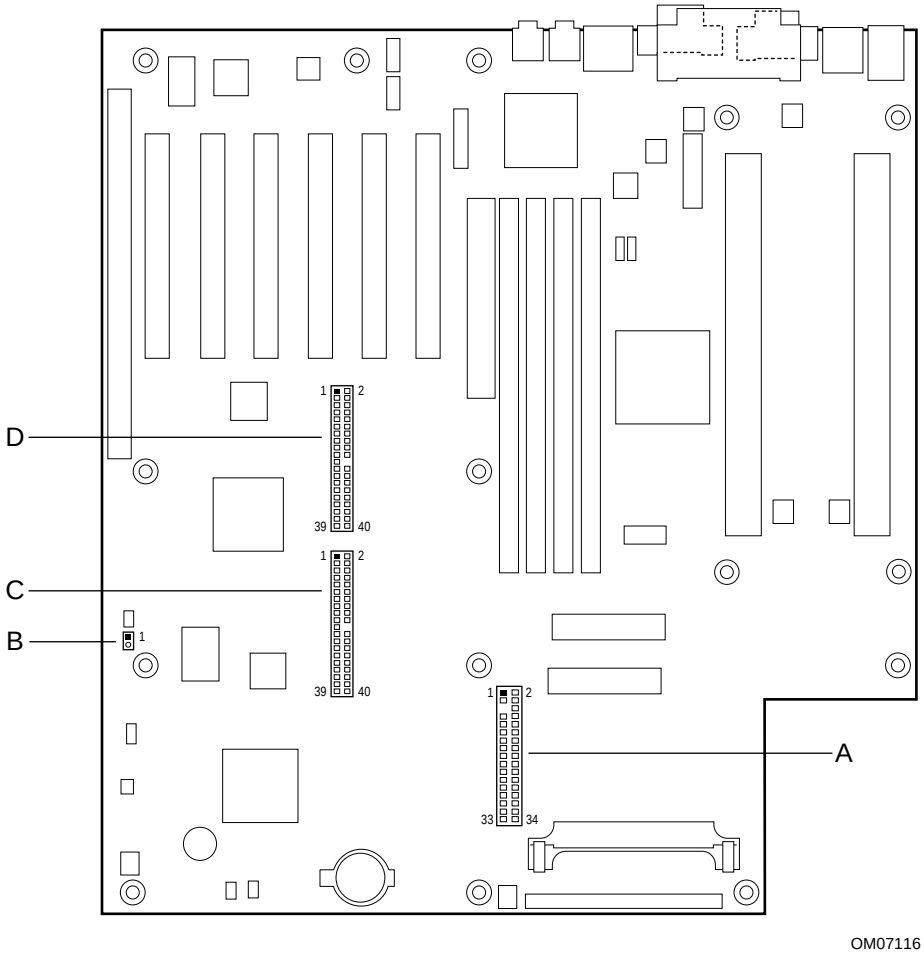
Pin	Signal Name	Pin	Signal Name
1	+3.3 V	11	+3.3 V
2	+3.3 V	12	-12 V
3	Ground	13	Ground
4	+5 V	14	PWS_ON# (power supply remote on/off control)
5	Ground	15	Ground
6	+5 V	16	Ground
7	Ground	17	Ground
8	PWRGD (Power Good)	18	-5 V
9	+5 VSB	19	+5 V
10	+12 V	20	+5 V

Table 50. VRM Connector (J13J1)

Pin	Signal Name	Pin	Signal Name
1	5VIN	21	VSS
2	5VIN	22	VCC
3	5VIN	23	VCC
4	5VIN	24	VSS
5	5VIN	25	VSS
6	5VIN	26	VCC
7	12VIN	27	VCC
8	12VIN	28	VSS
9	12VIN	29	VSS
10	SENSE	30	VCC
11	No connect	31	VCC
12	OUTEN	32	VSS
13	VID0	33	VSS
14	VID1	34	VCC
15	VID2	35	VCC
16	VID3	36	VSS
17	VID4	37	VSS
18	PWRGOOD	38	VCC
19	VCC	39	VCC
20	VSS	40	VSS

Peripheral Interface Connectors

Figure 22 shows the location of the peripheral interface connectors.



A Diskette Drive
B SCSI LED
C Secondary IDE
D Primary IDE

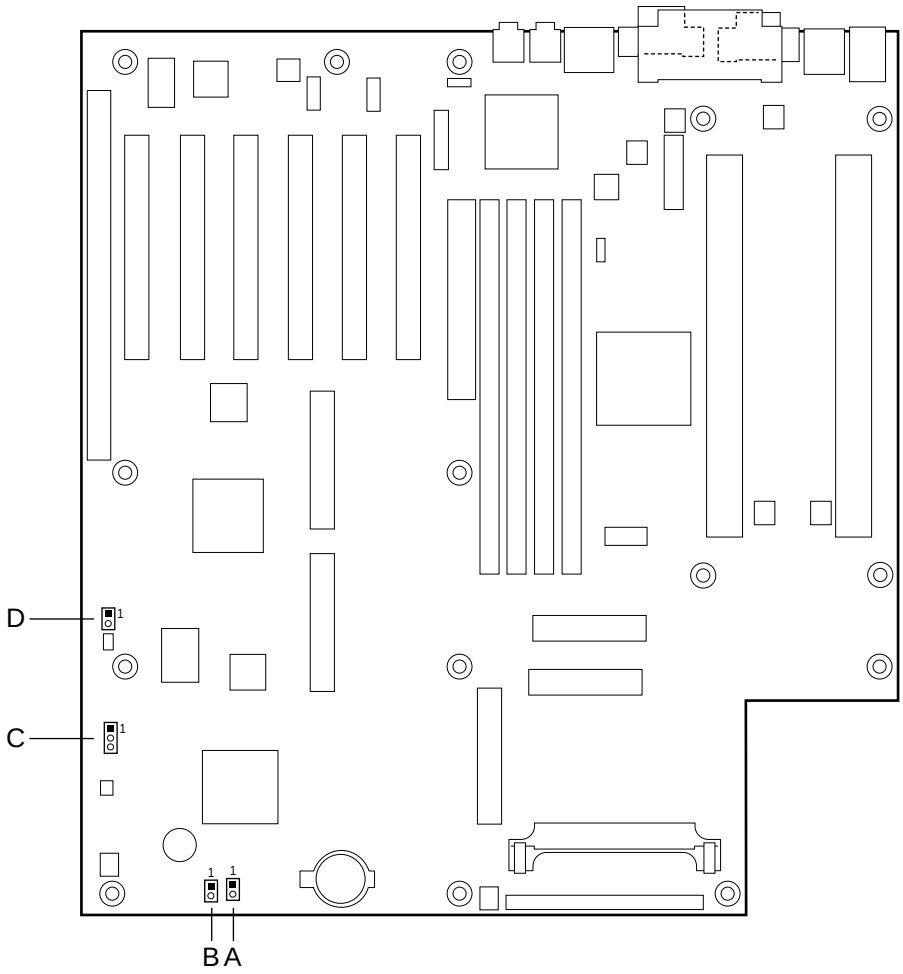
Figure 22. Peripheral Interface Connectors

Table 51. SCSI LED Connector (J10A1)

Pin	Signal Name
1	SCSI_LED#
2	Ground

Security and Hardware Management Connectors

Figure 23 shows the security and hardware management connectors. Tables 52 through 54 list the pinouts of the security and hardware management connectors.



A Rear Chassis Intrusion
B Front Chassis Intrusion
C Wake On LAN technology connector
D Wake On Modem

Figure 23. Security and Hardware Management Connectors

Table 52. Front and Rear Chassis Intrusion Connectors

Pin	Signal Name
1	TAMPER_DETECT#
2	Ground

Table 53. Wake on LAN Technology Connector (J11A2)

Pin	Signal Name
1	AUX5
2	Ground
3	WOL_PIN3

Table 54. Wake on Modem Connector (J9A1)

Pin	Signal Name
1	Ground
2	MODEMRING #

Chassis Intrusion Connectors

If the chassis cover is removed, then a security feature of the hardware monitor subsystem detects the intrusion.

This security feature uses mechanical switches on the chassis that are attached to the 1x2-pin chassis intrusion connectors. During normal computer operation, the mechanical switch is OPEN.

If a chassis intrusion event occurs when the AC power is OFF, the system remembers the occurrence.

Wake on LAN Technology Connector

This connector supports the Wake on LAN technology feature. Attach this connector to a network interface card (NIC) that supports Wake on LAN technology.

The NIC monitors network traffic. When the NIC detects a Magic Packet†, then it asserts a signal through the Wake on LAN technology connector to wake up the computer. This signal can wake up the computer only when the power cord is still plugged into the socket and the computer is turned OFF. Wake on LAN can be enabled through the BIOS Setup program.

The 82558 LAN component on the motherboard also supports Wake on LAN.

NOTE

The computer's power supply must provide sufficient +5 VSB current to the NIC. Without sufficient +5 VSB current, the Wake on LAN feature will not function and the motherboard may not boot. Check the NIC's documentation for its +5 VSB current requirements.

Wake on Modem

This feature allows the computer to wake from Sleep mode when a call is received on a telephony device, such as a modem. The first incoming call will power up the motherboard, but a second call must be made to access the computer.

Memory Map

Table 55. Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K - 2097152 K	100000 - 7FFFFFFF	2047 MB	Extended memory (SDRAM)
928 K - 1024 K	E8000 - FFFFF	96 KB	System BIOS
800 K - 928 K	C8000 - E7FFF	128 KB	Available high DOS memory (open to ISA and PCI bus)
640 K - 800 K	A0000 - C7FFF	160 KB	Video memory and BIOS
639 K - 640 K	9FC00 - 9FFFF	1 KB	Extended BIOS data (movable by memory manager software)
512 K - 639 K	80000 - 9FBFF	127 KB	Extended conventional memory
0 K - 512 K	00000 - 7FFFF	512 KB	Conventional memory

DMA Channels

Table 56. DMA Channels

DMA Channel Number	Data Width	System Resource
0	8 or 16 bits	Audio
1	8 or 16 bits	Audio / parallel port
2	8 or 16 bits	Diskette drive
3	8 or 16 bits	Parallel port (for ECP)/audio
4		Reserved - cascade channel
5	16 bits	Open
6	16 bits	Open
7	16 bits	Open

I/O Map

Table 57. I/O Map

Address (hex)	Size	Description
0000 - 000F	16 bytes	PIIX4 - DMA 1
0020 - 0021	2 bytes	PIIX4 - interrupt controller 1
002E - 002F	2 bytes	Super I/O controller configuration registers
0040 - 0043	4 bytes	PIIX4 - Counter/Timer 1
0048 - 004B	4 bytes	PIIX4- Counter/Timer 2
0060	1 byte	Keyboard Controller Byte - Reset IRQ
0061	1 byte	PIIX4 - NMI, Speaker Control
0064	1 byte	Keyboard controller, CMD/STAT Byte
0070, bit 7	1 bit	PIIX4 - enable NMI
0070, bits 6:0	7 bits	PIIX4 - real time clock, address
0071	1 byte	PIIX4 - real time clock, data
0078	1 byte	Reserved - motherboard configuration
0079	1 byte	Reserved - motherboard configuration
0080 - 008F	16 bytes	PIIX4 - DMA page registers
00A0 - 00A1	2 bytes	PIIX4 - interrupt controller 2
00B2 - 00B3	2 bytes	APM control
00C0 - 00DE	31 bytes	PIIX4 - DMA 2
00F0	1 byte	Reset numeric error
0170 - 0177	8 bytes	Secondary IDE channel
01F0 - 01F7	8 bytes	Primary IDE channel
0200 - 0207	8 bytes	Audio / game port
0220 - 022F	16 bytes	Audio (Sound Blaster compatible)
0240 - 024F	16 bytes	Audio (Sound Blaster compatible)
0278 - 027F	8 bytes	LPT2
0290 - 0297	8 bytes	Hardware monitor
02E8 - 02EF	8 bytes	COM4/Video (8514A)
02F8 - 02FF	8 bytes	COM2
0300 - 0301	2 bytes	MPU-401 (MIDI)
0330 - 0331	2 bytes	MPU-401 (MIDI)
0332 - 0333	2 bytes	MPU-401 (MIDI)
0334 - 0335	2 bytes	MPU-401 (MIDI)
0376	1 byte	Secondary IDE channel command port
0377	1 byte	Floppy channel 2 command
0377, bit 7	1 bit	Floppy disk change, channel 2
0377, bits 6:0	7 bits	Secondary IDE channel status port

Continued

Table 57. I/O Map (continued)

Address (hex)	Size	Description
0378 - 037F	8 bytes	LPT1
0388- 038D	6 bytes	AdLib (FM synthesizer)
03B4 - 03B5	2 bytes	Video (VGA†)
03BA	1 byte	Video (VGA)
03BC - 03BF	4 bytes	LPT3
03C0 - 03CA	11 bytes	Video (VGA)
03CC	1 byte	Video (VGA)
03CE - 03CF	2 bytes	Video (VGA)
03D4 - 03D5	2 bytes	Video (VGA)
03DA	1 byte	Video (VGA)
03E8 - 03EF	8 bytes	COM3
03F0 - 03F5	6 bytes	Floppy Channel 1
03F6	1 byte	Primary IDE channel command port
03F7 (Write)	1 byte	Floppy channel 1 command
03F7, bit 7	1 bit	Floppy disk change channel 1
03F7, bits 6:0	7 bits	Primary IDE channel status port
03F8 - 03FF	8 bytes	COM1
04D0 - 04D1	2 bytes	Edge/level triggered PIC
0530 - 0537	8 bytes	Windows Sound System
0604 - 060B	8 bytes	Windows Sound System
LPTn + 400h	8 bytes	ECP port, LPTn base address + 400h
0CF8 - 0CFB*	4 bytes	PCI configuration address register
0CF9**	1 byte	Turbo and reset control register
0CFC - 0CFF	4 bytes	PCI configuration data register
0E80 - 0E87	8 bytes	Windows Sound System
0F40- 0F47	8 bytes	Windows Sound System
0FF0 - 0FF7	8 bytes	CS4236B audio control
FF00 - FF07	8 bytes	IDE bus master register
FFA0 - FFA7	8 bytes	Primary bus master IDE registers
FFA8 - FFAF	8 bytes	Secondary bus master IDE registers
007C, bits 5:4	2 bits	Chassis fan RPM sense selection

* DWORD access only

** Byte access only

PCI Configuration Space Map

Table 58. PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Description
00	00	00	Intel 82443GX (PAC)
01	00	00	Intel 82443GX PCI-to-PCI Bridge (for A.G.P.)
00	0C	00	Intel 82371EB (PIIX4E) PCI/ISA Bridge
00	0C	01	Intel 82371EB (PIIX4E) IDE Bus Master
00	0C	02	Intel 82371EB (PIIX4E) USB
00	0C	03	Intel 82371EB (PIIX4E) Power Management
00	02	00	Intel 82558 PCI LAN Controller
00	0D	00*	PCI expansion slot 1
00	0E	00*	PCI expansion slot 2
00	0F	00*	PCI expansion slot 3
00	10	00*	PCI expansion slot 4
00	11	00*	PCI expansion slot 5
00	12	00*	PCI expansion slot 6

* Function numbers depend upon Add-in Card used. (Typical card = 00)

LAN Subsystem Software

The EtherExpress PRO/100 WfM PCI LAN software provided includes setup/diagnostic software (SETUP.EXE), a readme file viewer (README.EXE) and drivers. The LAN software is available from Intel's World Wide Web site.

Interrupts

Table 59. Interrupts

IRQ	System Resource
NMI	I/O channel check
0	Reserved, interval timer
1	Reserved, keyboard buffer full
2	Reserved, cascade interrupt from slave PIC
3	COM2*
4	COM1*
5	LPT2 (Plug and Play option) / audio / user available / shared
6	Diskette drive
7	LPT1* / shared
8	Real time clock
9	Windows Sound System* / shared
10	LAN / shared
11	User available / shared
12	Onboard mouse port (if present, else user available)
13	Reserved, math coprocessor
14	Primary IDE (if present, else user available)
15	Secondary IDE (if present, else user available)

* Default, but can be changed to another IRQ

PCI Interrupt Routing Map

This section describes interrupt sharing and how the interrupt signals are connected between the PCI expansion slots and onboard PCI devices. The PCI specification states how interrupts can be shared between devices attached to the PCI bus. In most cases, the small amount of latency added by interrupt sharing does not affect the operation **or** throughput of the devices.

Where maximum performance is needed from a device, a PCI device should not share an interrupt with other PCI devices. Use the following information to avoid sharing an interrupt with a PCI add-in card. Table 60 specifies the PCI device classifications identifying their interrupt group.

Table 60. PCI Device Classes

Device Classification	Class Definition/Specification
INTA	By default, all add-in cards that require only one interrupt are in this category. For almost all cards that require more than one interrupt, the first interrupt on the card is also classified as INTA.
INTB	Generally, the second interrupt on add-in cards that require two or more interrupts is classified as INTB. (This is not an absolute requirement.)
INTC	Generally, a third interrupt on add in cards is classified as INTC.
INTD	Generally, a fourth interrupt on add in cards is classified as INTD.

The PIIX4E PCI-to-ISA bridge has four programmable interrupt request (PIRQ) input signals. Any PCI interrupt source (either onboard or from a PCI add-in card) connects to one of these PIRQ signals.

Because there are only four signals, some PCI interrupt sources are mechanically tied together on the motherboard and, therefore, share the same interrupt. Table 60 lists the PIRQ signals and shows how the signals are connected to the PCI expansion slots and to onboard PCI interrupt sources.

Table 61. PCI Interrupt Routing Map

PIIX4E PIRQ Signal	PCI Slot 1	PCI Slot 2:	PCI Slot 3:	PCI Slot 4:	PCI Slot 5:	PCI Slot 6:	A.G.P.	PCI LAN	Power Management
PIRQA	INTA	INTD	INTC	INTB	INTA	INTD	INTA		X
PIRQB	INTB	INTA	INTD	INTC	INTB	INTA	INTB		
PIRQC	INTC	INTB	INTA	INTD	INTC	INTB		X	
PIRQD	INTD	INTC	INTB	INTA	INTD	INTC			

Interrupt Routing Example

IF an add-in card in the second PCI slot has one interrupt (group INTA)

THEN in this slot, an interrupt source from group INTA connects to the PIRQB signal

WHICH is not connected to any onboard interrupt sources

AND IF there are no other add-in cards

THEN this card does not share its interrupt with any other devices.

NOW plug a second add-in card

WITH two interrupts (groups INTA and INTB) into the first PCI slot

THEN INTA in the first slot is connected to signal PIRQA

AND INTB in the second slot is connected to signal PIRQB

RESULTING IN the second device on the two function add-in card in the first slot

SHARING its interrupt with the single function card

IN the second slot.

NOTE

The PIIX4E can connect each PIRQ line internally to one of the IRQ signals (3, 4, 5, 7, 9, 10, 11, 12, 14, or 15). Typically, a device that does not share a PIRQ line will have a unique interrupt. However, in certain interrupt-constrained situations, it is possible for two or more of the PIRQ lines to be connected to the same IRQ signal. In the presence of an SMP operating system, the IOAPIC is used instead of the PIIX4 to distribute interrupts.

A Error Messages

This appendix describes system error messages and alarms which are triggered when operational errors are detected.

This appendix covers the following topics:

Topic/Procedure	Page
BIOS Beep Codes	112
BIOS Error Messages	113
Port 80h POST Codes	114

BIOS Beep Codes

Beep codes represent a terminal error. If the BIOS detects a terminal error condition, then the BIOS outputs an error beep code, halts the POST, and attempts to display a port 80h code on the POST card's LED display.

Table 62 displays the BIOS Beep Codes that can be generated and provides an explanation of each.

Table 62. Beep Codes

Beeps	80h Code	Description
1	B4h	One short beep before boot
1-2	98h	Search for option ROMs
1-2-2-3	16h	BIOS ROM checksum
1-3-1-1	20h	Test DRAM refresh
1-3-1-3	22h	Test keyboard controller
1-3-4-1	2Ch	RAM failure on address line *nnnn*
1-3-4-3	2Eh	RAM failure on data bits *nnnn* of low byte of memory bus
1-4-1-1	30h	RAM failure on data bits *nnnn* of high byte of memory bus
2-1-2-3	46h	Check ROM copyright notice
2-2-3-1	58h	Test for unexpected interrupts

nnnn = hexadecimal numbers

BIOS Error Messages

Table 63 lists the error messages generated by the system and explains the meaning of each message.

Table 63. BIOS Error Messages

Error Message	Explanation
Diskette drive A error or Diskette drive B error	Drive A or B is present but fails the POST diskette tests. Check that the drive is defined with the proper diskette type in Setup and that the diskette drive is installed correctly.
Extended RAM Failed at offset: *nnnn*	Extended memory not working or not configured properly at offset *nnnn*.
Failing Bits: *nnnn*	The number *nnnn* is a map of the bits at the RAM address (System, Extended, or Shadow memory) that failed the memory test. Each 1 in the map indicates a failed bit.
Fixed Disk 0 Failure or Fixed Disk 1 Failure or Fixed Disk Controller Failure	Fixed disk is not working or not configured properly. Check to see if fixed disk is installed properly. Run Setup be sure the fixed-disk type is correctly identified.
Incorrect Drive A type - run SETUP	Type of diskette drive for drive A not correctly identified in Setup.
Incorrect Drive B type - run SETUP	Type of diskette drive for drive B not correctly identified in Setup.
Invalid NVRAM media type	Problem with NVRAM (CMOS) access.
Keyboard controller error	The keyboard controller failed test. Try replacing the keyboard.
Keyboard error	Keyboard not working.
Keyboard error *nn*	BIOS discovered a stuck key and displays the scan code nn for the stuck key.
Keyboard locked - Unlock key switch	Unlock the system to proceed.
Monitor type does not match CMOS - Run SETUP	Monitor type not correctly identified in Setup.
Operating system not found	Operating system cannot be located on either drive A or drive C. Enter Setup and see if fixed disk and drive A are properly identified.
Parity Check 1	Parity error found in the system bus. BIOS attempts to locate the address and display it on the screen. If it cannot locate the address, it displays ????.
Parity Check 2	Parity error found in the I/O bus. BIOS attempts to locate the address and display it on the screen. If it cannot locate the address, it displays ????.
Press <F1> to resume, <F2> to Setup	Displayed after any recoverable error message. Press <F1> to start the boot process or <F2> to enter Setup and change any settings.

Continued

Table 63. BIOS Error Messages (continued)

Error Message	Explanation
Real time clock error	Real-time clock fails BIOS test. May require motherboard repair.
Shadow RAM Failed at offset: *nnnn*	Shadow RAM failed at offset nnnn of the 64 KB block at which the error was detected.
System battery is dead - Replace and run SETUP	The CMOS clock battery indicator shows the battery is dead. Replace the battery and run Setup to reconfigure the system.
System cache error - Cache disabled	RAM cache failed the BIOS test. BIOS disabled the cache.
System CMOS checksum bad - run SETUP	System CMOS RAM has been corrupted or modified incorrectly, perhaps by an application program that changes data stored in CMOS. Run Setup and reconfigure the system either by getting the default values and/or making your own selections.
System RAM Failed at offset: *nnnn*	System RAM failed at offset *nnnn* of the 64 KB block at which the error was detected.
System timer error	The timer test failed. Requires repair of system motherboard.

nnnn = hexadecimal numbers

Port 80h POST Codes

During the POST, the BIOS generates diagnostic progress codes (POST codes) to I/O port 80h. If the POST fails, then execution stops and the last POST code generated is left at port 80h. This code is useful for determining the point where an error occurred.

Displaying the POST codes requires an add-in card (often called a POST card). The POST card can decode the port and display the contents on a medium such as a seven-segment display. These cards can be purchased from JDR Microdevices or other sources.

The following table provides the POST codes that can be generated by the BIOS. Some codes are repeated in the table because that code applies to more than one operation.

Table 64. Port 80h Codes

Code	Description of POST Operation
02h	Verify real mode
03h	Disable non-maskable interrupt (NMI)
04h	Get processor type
06h	Initialize system hardware
08h	Initialize chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialize CPU registers
0Bh	Enable CPU cache
0Ch	Initialize caches to initial POST values
0Eh	Initialize I/O component
0Fh	Initialize the local bus IDE
10h	Initialize power management
11h	Load alternate registers with initial POST valuesnew
12h	Restore CPU control word during warm boot
13h	Initialize PCI bus mastering devices
14h	Initialize keyboard controller
16h	BIOS ROM checksum
17h	Initialize cache before memory autosize
18h	8254 timer initialization
1Ah	8237 DMA controller initialization
1Ch	Reset programmable interrupt controller
20h	Test DRAM refresh
22h	Test keyboard controller
24h	Set ES segment register to 4 GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialize POST memory manager

Continued

Table 64. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
2Ah	Clear 512 KB base RAM
2Ch	RAM failure on address line nnnn
2Eh	RAM failure on data bits nnnn of low byte of memory bus
2Fh	Enable cache before system BIOS shadow
30h	RAM failure on data bits nnnn of high byte of memory bus
32h	Test CPU bus-clock frequency
33h	Initialize POST dispatch manager
34h	Test CMOS RAM
35h	Initialize alternate chipset registers
36h	Warm start shut down
37h	Reinitialize the chipset (MB only)
38h	Shadow system BIOS ROM
39h	Reinitialize the cache (MB only)
3Ah	Autosize cache
3Ch	Configure advanced chipset registers
3Dh	Load alternate registers with CMOS valuesnew
40h	Set Initial CPU speed new
42h	Initialize interrupt vectors
44h	Initialize BIOS interrupts
45h	POST device initialization
46h	Check ROM copyright notice
47h	Initialize manager for PCI option ROMs
48h	Check video configuration against CMOS RAM data
49h	Initialize PCI bus and devices
4Ah	Initialize all video adapters in system
4Bh	Display QuietBoot screen
4Ch	Shadow video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialize EISA motherboard
52h	Test keyboard
54h	Set key click if enabled
56h	Enable keyboard
58h	Test for unexpected interrupts
59h	Initialize POST display service
5Ah	Display prompt "Press F2 to enter SETUP"
5Bh	Disable CPU cache

Continued

Table 64. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
5Ch	Test RAM between 512 and 640 KB
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialize multiprocessor APIC
68h	Enable external and processor caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Ch	Display shadow-area message
6Eh	Display possible high address for UMB recovery
70h	Display error messages
72h	Check for configuration errors
74h	Test real-time clock
76h	Check for keyboard errors
7Ah	Test for key lock on
7Ch	Set up hardware interrupt vectors
7Eh	Initialize coprocessor if present
80h	Disable onboard Super I/O ports and IRQs
81h	Late POST device initialization
82h	Detect and install external RS232 ports
83h	Configure non-MCD IDE controllers
84h	Detect and install external parallel ports
85h	Initialize PC-compatible PnP ISA devices
86h	Re-initialize onboard I/O ports
87h	Configure motherboard configurable devices
88h	Initialize BIOS Data Area
89h	Enable Non-Maskable Interrupts (NMIs)
8Ah	Initialize extended BIOS data area
8Bh	Test and initialize PS/2 mouse
8Ch	Initialize diskette drive controller
8Fh	Determine number of ATA drives
90h	Initialize hard-disk controllers
91h	Initialize local-bus hard-disk controllers
92h	Jump to UserPatch2
93h	Build MPTABLE for multiprocessor boards
94h	Disable A20 address line
95h	Install CD ROM for boot

Continued

Table 64. Port 80h Codes (continued)

Code	Description of POST Operation Currently In Progress
96h	Clear huge ES segment register
97h	Fix up multiprocessor table
98h	Search for option ROMs
99h	Check for SMART Drive
9Ah	Shadow option ROMs
9Ch	Set up power management
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day
A2h	Check key lock
A4h	Initialize typematic rate
A8h	Erase F2 prompt
AAh	Scan for F2 key stroke
ACh	Enter SETUP
AEh	Clear IN POST flag
B0h	Check for errors
B2h	POST done - prepare to boot operating system
B4h	One short beep before boot
B5h	Terminate QuietBoot
B6h	Check password (optional)
B8h	Clear global descriptor table
B9h	Clean up all graphics
BAh	Initialize DMI parameters
BBh	Initialize PnP Option ROMs
BCh	Clear parity checkers
BDh	Display MultiBoot menu
BEh	Clear screen (optional)
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19
C1h	Initialize POST Error Manager (PEM)
C2h	Initialize error logging
C3h	Initialize error display function
C4h	Initialize system error handler

Continued

Table 64. Port 80h Codes (continued)

Code	Description of POST Operation (The following are for boot block in flash memory)
E0h	Initialize the chipset
E1h	Initialize the bridge
E2h	Initialize the processor
E3h	Initialize system timer
E4h	Initialize system I/O
E5h	Check force recovery boot
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Set huge segment
E9h	Initialize multiprocessor
EAh	Initialize OEM special code
EBh	Initialize PIC and DMA
ECh	Initialize memory type
EDh	Initialize memory size
EEh	Shadow boot block
EFh	System memory test
F0h	Initialize interrupt vectors
F1h	Initialize runtime clock
F2h	Initialize video
F3h	Initialize beeper
F4h	Initialize boot
F5h	Clear huge segment
F6h	Boot to mini-DOS
F7h	Boot to full DOS

nnnn = hexadecimal numbers

B Regulatory and Integration Information

This appendix contains:

- Safety standards, electromagnetic compatibility regulations, and product certification markings for this motherboard
- Instructions and precautions for integrators who are installing this motherboard in a chassis

This appendix covers the following topics:

Topic/Procedure	Page
Regulatory Compliance	122
Product Certification Markings	122
Installation Precautions	122
Installation Instructions	123
Ensure Electromagnetic Compatibility	123
Prevent Power Supply Overload	123
Place Battery Marking on the Computer	123
Use Only for Intended Applications	123

Regulatory Compliance

This motherboard complies with the following safety and electromagnetic compatibility (EMC) regulations when correctly installed in a compatible host system.

Table 65. Safety Regulations

Regulation	Title
UL 1950 - CSA 950-95, 3rd edition, Dated 07-28-95	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (USA and Canada)
IEC 950, 2nd edition, 1991 (with Amendments 1, 2, 3, and 4)	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (International)

Table 66. EMC Regulations

Regulation	Title
FCC Class A	Title 47 of the Code of Federal Regulations, Parts 2 and 15, Subpart B, pertaining to unintentional radiators. (USA)

Product Certification Markings

This motherboard has the following product certification markings:

- European CE Marking: Consists of a marking on the board and/or shipping container.
- UL Recognition Mark: Consists of the UL File No. E186194 and a stylized backward UR on the component side of the board and the PB No. on the solder side of the board. Board material flammability is minimum 94V-1 or -0.
- Canadian Compliance: Consists of a small c followed by a stylized backward UR on the component side of the board.

Installation Precautions

When you install and test the motherboard, observe all warnings and cautions in the installation instructions.

To avoid injury, be careful of:

- Sharp pins on connectors
- Sharp pins on printed circuit assemblies
- Rough edges and sharp corners on the chassis
- Hot components (like processors, voltage regulators, and heat sinks)
- Damage to wires that could cause a short circuit

Observe all warnings and cautions that instruct you to refer computer servicing to qualified technical personnel.

Installation Instructions

CAUTION

Follow these guidelines to meet safety and regulatory requirements when installing this board assembly.

Read and adhere to all of these instructions and the instructions supplied with the host computer and associated modules. If the instructions for the host computer are inconsistent with these instructions or the instructions for associated modules, contact the supplier's technical support to find out how you can ensure that your computer meets safety and regulatory requirements. If you do not follow these instructions and the instructions provided by host computer and module suppliers, you increase safety risk and the possibility of noncompliance with regional laws and regulations.

Ensure Electromagnetic Compatibility (EMC)

Integration of this motherboard is a regulated activity. The integrator is responsible to ensure the end product is tested in accordance with local and national requirements.

Prevent Power Supply Overload

When integrating this motherboard, care should be taken to ensure the power supply is not overloaded. Make sure that the calculated total load current of all modules within the computer is less than the output current rating of the power supply. Failure to ensure correct power supply loading could create an unsafe condition. If the load drawn by a module cannot be determined by the markings and instructions supplied with the module, then contact the module supplier's technical support.

Place Battery Marking on the Computer

There is insufficient space on this motherboard to provide instructions for replacing and disposing of the battery. The following warning must be placed permanently and legibly on the host computer as near as possible to the battery or in the user instructions.

WARNING

Danger of explosion if battery is incorrectly replaced.

Replace with only the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Use Only for Intended Applications

This product was evaluated for use in computers that will be installed in offices, homes, schools, computer rooms, and similar locations. The suitability of this product for other applications, (such as medical, industrial, alarm systems, and test equipment) may require further evaluation.

C Environmental Specifications and Reliability Information

This appendix contains:

- Motherboard environmental requirements for safe operation and optimal performance.
- Reliability information related to the Mean Time Between Failures (MTBF) measure for the MS440GX motherboard.

This appendix covers the following topics:

Topic/Procedure	Page
Environmental Specification Table	126
Reliability Information	126

Environmental Specifications

Table 67. Environmental Specifications

Parameter	Specification		
Temperature			
Nonoperating	-40 °C to +70 °C		
Operating	0 °C to +55 °C		
Shock			
Unpackaged	50 G trapezoidal waveform		
	Velocity change of 170 inches/sec		
Packaged	Half sine 2 millisecond		
	Product Weight	**Free Fall (inches)**	**Velocity Change (inches/sec)**
	<20 lbs	36	167
	21-40 lbs	30	152
	41-80 lbs	24	136
	81-100 lbs	18	118
Vibration			
Unpackaged	5 Hz to 20 Hz : 0.01g² Hz sloping up to 0.02 g² Hz		
	20 Hz to 500 Hz : 0.02g² Hz (flat)		
Packaged	10 Hz to 40 Hz : 0.015g² Hz (flat)		
	40 Hz to 500 Hz : 0.015g² Hz sloping down to 0.00015 g² Hz		

Reliability Information

The mean time between failures (MTBF) prediction is calculated using component and subassembly random failure rates. The calculation is based on the Bellcore Reliability Prediction Procedure, TR-NWT-000332, Issue 4, September 1991.

The MTBF prediction can be used when estimating repair rates and spare parts requirements.

MTBF data is calculated from predicted data @ 55 °C.

The MTBF prediction for the MS440GX motherboard is 129,574 hours.

D Specifications and Customer Support

This appendix identifies where to obtain about Intel boards and details the specifications that the MS440GX motherboard is in compliance with.

This appendix covers the following topics:

Topic/Procedure	Page
Online Support	128
Specifications	128

Online Support

Find information about Intel boards under “Product Info” or “Customer Support” at this World Wide Web site:

http://www.intel.com/

Specifications

The motherboard complies with the following specifications:

Table 68. Compliance with Specifications

Specification	Description	Revision Level
A.G.P.	Accelerated Graphics Port Interface Specification	Revision 1.0, July 1996, Intel Corporation. The specification is available through the Accelerated Graphics Implementers Forum at: `http://www.agpforum.org/`
APM	Advanced Power Management BIOS interface specification	Revision 1.2, February 1996, Intel Corporation, Microsoft Corporation
ATA-3	Information Technology - AT Attachment-3 Interface	X3T10/2008D Revision 6 ATA Anonymous FTP Site: `fission.dt.wdc.com`
ATAPI	ATA Packet Interface for CD-ROMs	SFF-8020i Revision 2.5 (SFF) Fax Access: (408) 741-1600
ATX	ATX form factor specification	Revision 2.01, February 1997, Intel Corporation. The specification is available at: `http://www.intel.com/`
DIMMs	Module outline, 100- and 168-pin DIMMs	JEDEC Publication No. 95, MO-161, Rev. B, December 1996. This specification is available at: `http://www.eia.org/jedec`
DMI	Desktop Management Interface BIOS specification	Version 2.0, October 16, 1995 American Megatrends Inc., Award Software International Inc., Dell Computer Corporation, Intel Corporation, Phoenix Technologies Ltd., SystemSoft Corporation
El Torito	Bootable CD-ROM format specification	Version 1.0, January 25, 1995 Phoenix Technologies Ltd., IBM Corporation. The El Torito specification is available at: `http://www.ptltd.com/techs/specs.html`
EPP	Enhanced Parallel Port	IEEE 1284 standard, Mode [1 or 2], v1.7
Multiprocessor systems	Multiprocessor specification	Version 1.4, May 1997, Intel Corporation
PCI	PCI Local Bus specification	Revision 2.1, June 1, 1995, PCI Special Interest Group
Plug and Play	Plug and Play BIOS specification	Version 1.0a, May 5, 1994, Compaq Computer Corporation, Phoenix Technologies Ltd., Intel Corporation
USB	Universal serial bus specification	Revision 1.0, January 15, 1996, Compaq Computer Corporation, Digital Equipment Corporation, IBM PC Company, Intel Corporation, Microsoft Corporation, NEC, Northern Telecom